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Using the Catalog

The Lehigh University Catalog lists degree requirements, rules for graduation, and other policies and procedures affecting students at Lehigh University. The University normally updates the Catalog on an annual basis, to reflect changes in course descriptions, degree programs, and academic guidelines. Most policies and procedures are governed by the language in the current Catalog.

Understanding Catalog Years and Graduation Requirements

In order to be eligible to graduate, a student must complete requirements defined in a specific Catalog. In general, students follow the requirements for graduation listed in the Catalog current at the time they matriculate, that is, at the time they first enroll as a degree-seeking student at Lehigh. Previously non-matriculated students who then matriculate at Lehigh University will be governed by the graduation requirements of the Catalog in effect at the time of their matriculation. Graduation requirements for the academic colleges are listed in the individual sections of the Catalog.

With the departmental advisor's consent and approval from their college dean's office or college advising office, students may elect a later Catalog under which to fulfill the degree requirements; they may not elect an earlier Catalog, nor use a combination of requirements from different Catalogs. Should a student receive an exception to combine requirements from different Catalogs, the student must follow the University's degree exception process for each individual change to the original requirements outlined on the degree audit. All exceptions must be approved by the student's advisor, the academic department, and the Associate Dean of the college.

Students returning to the University after an extended period without enrollment should meet with an advisor before selecting courses upon their return or readmission, to confirm which graduation requirements apply to them, because academic policies and procedures may have substantively changed during the period of their absence. When courses required in an older Catalog are no longer offered, or in other special cases, course substitutions may be made with the approval of appropriate department chairs, departmental advisors or deans.

In addition to the academic and semester-hour requirements for graduation in the several colleges and curricula, all students also must meet the residence requirements of the University (either a minimum of ninety semester hours, or at least sixty of the last seventy-five semester hours) and complete all work to be credited toward a baccalaureate degree within an eight-year period. If the work is not completed within this period the student may petition for an extension. If an extension of time to complete the degree is approved, then the advising office of the college in which the student is enrolled, in consultation with the student's departmental advisor, will determine which Catalog will govern degree requirements.

The University reserves the right at any time to make changes deemed necessary in the regulations, fees, courses, or programs described in the Catalog, and to cancel any course if registration does not justify its continuance or if qualified faculty members become unavailable. The University will make efforts to give notice of all substantive changes as appropriate. The Catalog is ordinarily updated annually.

Programs and Majors

Strong programs in business, the humanities, education, arts and sciences, and human services complement our well-known strength in engineering. Lehigh students can choose from an array of courses and enjoy the resources and facilities of a major research university and the atmosphere and personal attention of a small college.

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Mission, Vision and Values

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Lehigh's Mission statement

To advance learning through the integration of teaching, research, and service to others.

(Adopted 1992)

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Lehigh's Vision Statement

Lehigh University prepares graduates to engage with the world and lead lives of meaning. We commit to:

- National and international research prominence
- Learning experiences grounded in fundamental, transferable skills across all disciplines and in real world challenges
- Strategic risk-taking in the presence of opportunity and adversity
- Social, environmental and economic sustainability
- Meaningful connection and partnership with alumni, supporters and citizens around the globe
- A robust return on the investment in a Lehigh education
- A diverse, inclusive and financially accessible environment

(Adopted 2016)

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LEHIGH'S CORE VALUES

Essential and enduring tenets -- a small set of timeless guiding principles that require no external justification; they have intrinsic value and importance.

- Integrity and honesty
- Equitable community
- Academic freedom
- Intellectual curiosity
- Collaboration
- Commitment to excellence
- Leadership

(Adopted 2007)

The Principles of our Equitable Community

THE PRINCIPLES OF OUR EQUITABLE COMMUNITY

Lehigh University is first and foremost an educational institution, committed to **developing the future leaders of our changing global society**. Every member of our community has a personal responsibility to acknowledge and practice the following basic principles:

- We **affirm the inherent dignity** in all of us, and we maintain an inclusive and equitable community.
- We **recognize and celebrate** the richness contributed to our lives by our diverse community.
- We **promote mutual understanding** among the members of our community.
- We **confront and reject discrimination in all its forms**, including that based on age, color, disability, gender identity, genetic information, marital status, national or ethnic origin, political beliefs, race, religion, sex, sexual orientation, socio-economics, veteran status, or any differences that have been excuses for misunderstanding, dissension, or hatred.
- We **affirm academic freedom** within our community and uphold our commitment to the highest standards of **respect, civility, courtesy, and sensitivity** toward every individual.
- We **recognize each person's right to think and speak** as dictated by personal belief and to **respectfully** disagree with or counter another's point of view.
- We **promote open expression of our individuality and our differences** within the bounds of **University policies**.
- We **acknowledge each person's obligation to the community** of which we have chosen to be a part.
- We take **pride** in building and maintaining a culture that is founded on these **principles of unity and respect**.

(Adopted 2011)

Non-discrimination statement

Lehigh University upholds *The Principles of Our Equitable Community* and is committed to providing an educational, working, co-curricular, social, and living environment for all students, staff, faculty, trustees, contract workers, and visitors that is free from harassment and discrimination on the basis of age, color, disability, gender identity or expression, genetic information, marital or familial status, national or ethnic origin, race, religion, sex, sexual orientation, or veteran status. Such harassment or discrimination is unacceptable behavior and will not be tolerated.

The University strongly encourages (and, depending upon the circumstances, may require) students, faculty, staff or visitors who experience or witness harassment or discrimination, or have information about harassment or discrimination in University programs or activities, to immediately report such conduct.

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Academic Calendar

The academic year consists of two regular terms (fall and spring), a winter term and one summer term. Lehigh University defines a regular semester as 14 weeks and 70 individual days of instruction. When classes have ended, two (2) full days are scheduled as the reading-consultation and study period, to allow students time to prepare for final examinations. Final examinations are scheduled on nine (9) consecutive calendar days, and each day will have four (4) consecutive 3-hour exam periods per day. The winter term is four (4) weeks and the summer term is twelve (12) weeks with measured sessions.

Please note the academic calendar is subject to change without notice. The most current calendar **(**https://ras.lehigh.edu/content/current-students/academic-calendar/**) is available on the** O **(**https://ras.lehigh.edu**)**ffice of the Registrar website **(**https://ras.lehigh.edu**).**

FALL 2024

FULL TERM		
August 26	Monday	First day of class
December 6	Friday	Last day of class
December 10	Tuesday	Final exams begin
December 18	Wednesday	Final exams end
FIRST PART OF TERM		
August 26	Monday	First day of class
October 11	Friday	Last day of class
SECOND PART OF TERM		
October 15	Tuesday	First day of class
December 6	Friday	Last day of class

SPRING 2024

FULL TERM		
January 20	Monday	First day of class
May 2	Friday	Last day of class
May 6	Tuesday	Final exams begin
May 14	Wednesday	Final exams end
May 17	Saturday	Graduate Commencement & Doctoral Hooding Ceremony
May 18	Sunday	Undergraduate Commencement Ceremony
FIRST PART OF TERM		
January 20	Monday	First day of class
March 7	Friday	Last day of class
SECOND PART OF TERM		
March 17	Monday	First day of class
May 2	Friday	Last day of class

Information of General Interest

ACCREDITATION

Lehigh University is accredited by the Middle States Commission on Higher Education, 1007 North Orange Street, 4th Floor, MB #166, Wilmington, DE 19801. The Middle States Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The College of Business accounting and business programs are accredited by the Association to Advance Collegiate Schools of Business (AACSB) International. AACSB International is a specialized accrediting body for business schools that offer undergraduate, master's, and doctoral degrees in business and accounting, and is recognized by the Council for Higher Education Accreditation.

The Commonwealth of Pennsylvania approves for educational certification various programs within the College of Education; in addition, specific programs carry additional accreditations, certifications and approvals. The counseling psychology doctoral program and the school psychology doctoral program are accredited by the American Psychological Association, Commission on Accreditation. The APA-CoA is a specialized accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation. The doctoral program and the educational specialist program in school psychology are approved by the National Association of School Psychologists. NASP is one of the specialized professional associations (SPAs) of the Council for Accreditation of Educator Preparation (CAEP), which is recognized by the Council for Higher Education Accreditation. The master's program in counseling and human services is accredited by the Masters in Psychology and Counseling Accreditation Council. MPCAC is a member of the Association of Specialized and Professional Accreditors, which is recognized by the Council for Higher Education Accreditation.

The engineering programs that are accredited by the Engineering Accreditation Commission or the Computing Accreditation Commission of ABET, http://www.abet.org (p. 10) are listed under the Undergraduate Studies section, P.C. Rossin College of Engineering and Applied Science, Major Programs. The bachelor of science in computer science in the College of Arts and Sciences is also accredited by the Computing Accreditation Commission of ABET. ABET is a specialized accrediting agency recognized by the Council for Higher Education Accreditation.

The computer science and business program is accredited by both the Computing Accreditation Commission of ABET and AACSB International.

The department of theatre is accredited by the National Association of Schools of Theatre, Commission on Accreditation, which is recognized by the U.S. Department of Education as the accrediting body for the field of theatre.

The bachelor of science degree in chemistry is certified by the American Chemical Society.

HIGHER EDUCATION OPPORTUNITY ACT DISCLOSURES

The Higher Education Act of 1965 (HEA), as amended by the Higher Education Opportunity Act of 2008 (HEOA), contains many information disclosures and reporting requirements. Lehigh University has a website which lists these disclosures as well as general consumer information by subject area, and provide links to references, reports and additional details.

The Office of the Provost oversees this website, found at https://provost.lehigh.edu/higher-education-opportunity-act-disclosures *(*https://provost.lehigh.edu/higher-education-opportunity-act-disclosures*/)*.

Entrance Examinations

Candidates for admission to any semester of the 2021-2022, 2022-2023 and 2023-2024 academic years are not required to take either the SAT or the ACT. Those who opt to take standardized testing do not need to sit for the writing component of either exam. Official test results should be sent directly to Lehigh through the College Board (CEEB code 2365) or ACT (ACT code 3612). In special circumstances, where the cost of sending test scores presents a financial hardship to the student or their family, students can self-report scores on the Common Application or Coalition Application or have their counselor submit unofficial scores. However, if a student requests the Office of Admission consider their self-reported test scores and the student is admitted, official scores must be sent from the testing agency prior to matriculation. The most up-to-date information on requirements can be found on the Lehigh Admissions website: www1.lehigh.edu/admissions/apply (https://www1.lehigh.edu/admissions/apply/).

Lehigh additionally requires the results from an English proficiency assessment for applicants whose first language is not English unless the applicant's first language is English, or the last two full years (not including current year of study) of completed formal instruction have been in English. The TOEFL and IELTS are preferred, however Duolingo English Test (https://englishtest.duolingo.com/applicants/) will be considered if those exams are not available to the student. Scores must be submitted directly from the testing/assessment agency and the most competitive candidates score above a 90 on the TOEFL, 7.0 on the IELTS or 110 on Duolingo. Students whose scores are lower than Lehigh's minimums are still considered for admission but may be required to take additional English courses during their first-year and/or during the summer semester prior to fall matriculation. SAT, SAT Subject Test, and ACT results cannot be used to meet the English proficiency requirement. The most up-to-date information on requirements for non-US citizens can be found on the Lehigh Admissions website: www1.lehigh.edu/admissions/undergrad/intl (http://www1.lehigh.edu/admissions/undergrad/intl/)

Recommendations

The Office of Admissions requires, as part of a candidate's file, a letter of recommendation from the school counselor, principal, or headmaster from the candidate's school. One teacher recommendation is also required. In addition to academic qualifications, recommendations should address the candidate's personal qualifications such as character, intellectual motivation, participation in school activities, and established habits of industry and dependability. Electronic submission through the Common Application website (http://www.commonapp.org/) or the Coalition Application website (https://www.coalitionforcollegeaccess.org/) is encouraged.

Admission and Deposit

Lehigh is a partner of the Common Application (https://www.commonapp.org/) and Coalition Application (https://www.coalitionforcollegeaccess.org/). for both first-year and transfer applicants. Deadlines, admission plans, and required documents can be found on the Application Requirements (https://www1.lehigh.edu/admissions/apply/) page. Any additional or missing documents should be submitted through a prospective student's application account with either the Common Application or Coalition Application. If you experience any issues or have questions please check our FAQs first; if you still have questions please contact the Office of Admissions at admissions@lehigh.edu or 610-758-3100.

Once your application is submitted, a confirmation email will be sent to the email address you designated in the application platform. The Office of Admissions discourages students from using a *school-related* email address due to its eventual expiration. If it has been more than seven business days since you submitted your application and you have not received a confirmation email, please contact the Office of Admissions at admissions@lehigh.edu or (610) 758-3100. In your email, please include your full name, address, and date of birth you provided in your application.

SUBJECT MATTER REQUIREMENTS

The coursework or units required for admission represent the equivalent of the usual four-year college preparatory curriculum. Minimum coursework requirements can be misleading since most students who gain admission to Lehigh University

exceed the minimum requirements. Below you will find the minimum requirements as well as recommended course work.

Minimum Requirements

English: 4
Foreign Languages[1]: 2
Social Science: 2
Laboratory Science: 2
College Preparatory Mathematics[2]: 3

Recommended Course work

English: 4

Foreign Languages[1]: 2

Social Science: 3

Laboratory Science: 3

College Preparatory Mathematics[2]: 4

[1] *Only in exceptional cases, and for otherwise well-qualified candidates, will the Committee on Admissions waive the Foreign Language requirement for admission to any one of the three undergraduate colleges.*

[2] *We recommend candidates for the P.C. Rossin College of Engineering and Applied Science and College of Business pursue a math curriculum that includes calculus.*

While there are many elements that contribute to Lehigh's holistic application review, the Committee on Admissions will be aware of things such as (in no particular order):

- The difficulty of courses taken with special attention given to courses recognized as accelerated by national academic organizations
- Rank or relative rank in class
- The student's grades within the context of the school's environment
- Evidence of improvement or deterioration in grades during the secondary school career with particular attention paid to performance in senior year courses
- The quality of performance in courses that relate to the student's anticipated area of study
- Comments and recommendations from the principal, headmaster, guidance counselor, teachers, or other professional educators within the school system
- Extra-curricular/work experience with particular emphasis placed on demonstrated leadership
- Demonstrated interest in Lehigh University

Admissions decisions are final and will be posted online via the Applicant Portal for each student. All admitted students are expected to meet or exceed the level of academic performance through graduation that contributed to their acceptance. An admitted student in the Regular Decision round may secure a place in the entering class by notifying the university that he or she intends to enroll at Lehigh and by submitting the appropriate non-refundable enrollment deposit via the Lehigh Portal by May 1. A student admitted through the binding Early Decision rounds must submit notification and deposit by the date indicated in his or her admission letter. This fee is applicable towards the fall-term bill. Students who do not attend will forfeit their deposit. In addition, students admitted through the binding Early Decision rounds are required to submit an admissions form verifying that active applications to other colleges and universities have been withdrawn.

Transfer Students

Students who have attended another college or university can be admitted with advanced standing. Candidates for transfer admission must meet the high school subject matter requirements prescribed for incoming first-year students. Exceptions to fulfilling high school requirements will be granted following the review of a college level transcript. The academic performance at the college level is the primary focus when giving consideration to admission.

Candidates who have been dropped for poor scholarship, who are not in good standing, or who have been released for disciplinary reasons are not eligible for admission.

Each candidate must submit an official transcript, course syllabi and course descriptions from each institution attended. While an admissions decision can be made without course syllabi and descriptions, the transfer credit evaluation process for those selected for admission will not begin until the course information is received. Information regarding transfer applications, including application deadlines, may be found at www.lehigh.edu/tapply (http://www.lehigh.edu/tapply/). Each application must be accompanied by an application fee of $70.

Students are encouraged to take an active role in seeing that the various components of their admission application have arrived at the university. Students will be notified by the Office of the Registrar as to the total transfer credits Lehigh will grant to the student.

HOUSING

Every effort is made to accommodate transfer student housing needs. All students are required to live on-campus through the end of the sophomore year. Contact the Office of Residential Services, Rathbone Hall, Lehigh University, 63 University Drive, Bethlehem, PA 18015 or call (610) 758-3500. This office also can provide information about off-campus housing. Fraternities and sororities often have room for members or boarders. Information on this option may be obtained through the Assistant Dean for Fraternity and Sorority Affairs (https://studentaffairs.lehigh.edu/node/2547/).

Advanced Placement

Please note decisions to award credit are reviewed annually and are subject to change.

Any student who takes a course for which credit has been awarded will forfeit their credit.

The university offers capable students who have superior preparation an opportunity for advanced placement and/or college credit. Many secondary schools, in association with the College Board, offer college-level work. Students participating in these courses should sit for the Advanced Placement Tests offered by the College Board.

Entering first-year students that request the College Board to send their Advanced Placement Test scores to Lehigh are considered for advanced placement.

Some departments noted below offer examinations during the first and third weeks of the semester to students who studied college-level subjects in secondary school but did not sit for the Advanced Placement Tests. Entering first-year students wishing to sit for an examination in any Lehigh course should fill out the Anticipatory Exam Form by the date given on the First-Year Student Portal. The student should specify the number and title of the course. Students who receive credit on the basis of Advanced Placement Test grades need not sit for the Lehigh tests to confirm the credit granted.

Students may contact Testing Services at inexams@lehigh.edu with questions about Chemistry, Computer Science, Mathematics, and Physics anticipatory exams.

Current practice at Lehigh is as follows:

Africana Studies

Four credit hours for AAS 091 will be awarded for students scoring 4 or higher on the AP African American Studies exam.

Art, Architecture and Design

Eight credit hours for ART 001 and ART 002 are granted to students who earn a grade of 5. Four credit hours for Art Elective in Art History are granted for those students who earn a grade of 4. Those students who earn grades of 5 on the Advanced Placement Studio Art Examination receive four credit hours for ART 073.

Biology

Four credit hours for BIOS 001 Biology For Non-Majors, given to those who earn grades of 4 or 5.

Chemistry

Four credit hours for CHM 030 are granted to students who earn a grade of 5 on the Advanced Chemistry Placement test or those who earn a B or higher for the A-level Chemistry exam. Four credit hours for CHM 030 are granted to students who earn a grade of 5 on the Advanced Chemistry Placement test or those who earn a B or higher for the A-level Chemistry exam. Credit for CHM 030 may also be earned by passing the Chemistry Anticipatory Exam offered by the Chemistry Department during the first and three weeks of the semester. Students may take this examination regardless of whether or not they have taken the advanced placement examination.

Computer Science
Students who receive a grade of 4 or 5 on the AP Computer Science A exam will receive four credits for CSE 007. Students who receive a grade of 4 or 5 on the AP Computer Science Principles will receive three credits of CSE 099. Credit for CSE 007 may also be earned by passing the Anticipatory Exam offered by the Computer Science department during the first and third weeks of the semester. Students may take this examination regardless of whether or not they have taken the advanced placement examination.

Economics
Students will receive two credit hours of Economics Elective for a score of 4 or 5 on the microeconomics or macroeconomics exam. Students receiving a score of 4 or 5 on both the microeconomics and macroeconomics exams will receive four credits for ECO 001 and two credits of Economics Elective and satisfy the College of Business degree requirements.

English

To receive credit for WRT 001 (3 credits), students must achieve one of the following:

- a score of 4 on either of the English AP exams,
- a score of 5 or higher on the IB exam

To receive credit for WRT 001 (3 credits) and WRT 002 (3 credits) students must achieve:

- a score of 5 on either of the English AP exams

Environmental Science

Students scoring a 4 or 5 on the environmental science exam will receive three credits for EES 002 and one credit for EES 022.

Government and Politics
Four credits for POLS 001 are awarded to those students that score a 4 or 5 on the American Government test, and four credits for POLS 003 are awarded to those that score a 4 or 5 on the Comparative Politics exam

History
Students earning a grade of 5 in the American History, European History or World History Advanced Placement examination will receive four credits of History elective for use as Social Science credit. Students may receive four credits for each exam grade of 5, which allows for a maximum of 12 total credits from AP History exam scores. These credits may not be applied to the History major or minor.

Human Geography

Four elective credits for GS 091 will be awarded to students scoring a 4 or 5 on the human geography exam. No distribution requirements will be assigned.

Latin
Students receive four semester hours of credit for a grade of 4 or 5 in the Virgil examination; those who successfully write in more than one area (e.g. Virgil and lyric poetry) receive eight hours of credit. Credit will be awarded for LAT 099 Latin Elective. Students receiving credit for Latin and who wish to continue their study of Latin must consult with the Director for proper placement.

Mathematics
Four semester hours of credit for MATH 021, Calculus I, are granted to those who earn grades of 4 or higher on the Calculus AB examination. To those who earn a grade of 4 or higher on the Calculus BC examination, eight hours of credit are granted for MATH 021 and MATH 022, Calculus I and II. Credit for MATH 021 and MATH 022 or both may also be earned by passing the anticipatory exam offered by the Mathematics Department during the first and third weeks of the semester. Students may take this examination regardless of whether they have taken the advanced placement examination. Students who earn a 4 or 5 on the Statistics AP Exam are granted 4 credits for MATH 012. Students who earn a grade of A or B in the portion of the A-Levels Mathematics Course covering the topics of MATH 021 are granted 4 credits for MATH 021, contingent on a review of the specific course syllabus by the Department of Mathematics. Students who earn a grade of A or B in the portion of the A-Levels Mathematics Course covering the topics of MATH 021 and MATH 022 will receive 8 credits for MATH 021 and MATH 022. Students who score 5 or higher on the Mathematics: Analysis and Approaches Higher Level (HL, not SL) IB Examinations will receive 4 credits for MATH 021, contingent on a review of the specific course syllabus and sample examinations by the Department of Mathematics. Students who score 6 or higher on the Mathematics: Analysis and Approaches Higher Level (HL, not SL) IB Examinations will receive 8 credits for MATH 021 and MATH 022, contingent on a review of the specific course syllabus and sample examinations by the Department of Mathematics.

Modern Languages and Literature
Students receive four semester hours of credit at the intermediate level I for grades of 4, and eight hours of credit at the intermediate level I & II for grades of 5 on the advanced placement tests. Those who write the SAT II subject tests and score 600 to 699 receive four hours of credit; 700 and above receive eight hours of credit. The maximum number of credits given is eight. Those students receiving grades of 4 or higher on the Spanish literature examination will receive four credits for SPAN 151.

Music
Two credit hours of Music elective are given to those students who earn a grade of 5 on the Advanced Placement test in Music, Listening/ Literature of Music: Theory. Students wishing to pursue theory at Lehigh must still take a placement exam.

Physics

Five hours of credit are given for PHY 011, PHY 012, for a score of 5 on the "Physics 1: Algebra-Based" examination (or, “Physics B” examination, for those who took the exam prior to 2015) or a score of 4 or higher on the "Physics C: Mechanics" examination. If a student receives this advanced placement credit for PHY 011 , five hours of credit will additionally be given for PHY 021, PHY 022, for a score of 4 or higher on the "Physics C: Electricity and Magnetism" examination. **PLEASE NOTE: Credit will only be awarded for PHY 021 & 022 if AP credit was awarded for PHY 011 & 012; credit for the "Physics C: Electricity and Magnetism" examination cannot be awarded after taking PHY 011 & 012 at Lehigh.**

Five hours of credit are given for PHY 011, PHY 012, and five hours of credit will additionally be given for PHY 021, PHY 022 for those students who receive a B or higher for Cambridge A-Level Physics.

Alternatively, Anticipatory Exams for PHY 011 and PHY 021 are offered to incoming students during the first and third week of the semester.

Psychology
Four credit hours of PSYC 001 are granted to students who earn a grade 4 or 5.

Statistics
Students scoring a 4 or 5 will receive four credits for MATH 012.

International Baccalaureate
Students who earn International Baccalaureate credit may be granted transfer credit for high-level or advanced subjects with scores of 5 or higher. All students will have their credentials evaluated on an individual basis for specific course equivalency once official International Baccalaureate scores have been received.

Please note decisions to award credit are reviewed annually and are subject to change.

Estimate of Expense for Undergraduates

Principally three areas of income support the operating expense of Lehigh University: tuition and fees, endowment earnings, and

gifts and grants. The university is conscious that educational costs are significant and it strives to maintain a program of high quality instruction while recognizing that there are limitations on what families can afford to pay. Costs will vary somewhat from student to student depending upon the various options chosen.

TUITION, ROOM, AND BOARD

There are three major plans that cover the major expense associated with university attendance. These are as follows:

The Tuition Plan

The university provides comprehensive academic and student services under its tuition plan. The tuition sum is inclusive of most athletic events, basic treatments in the Health Center, libraries, and laboratory services. A technology fee of $530 is charged to all full-time students. An additional $830 fee is charged to all students enrolled in the College of Engineering and Applied Science or with a declared major in natural science. The full-time tuition rate is charged to students enrolled in twelve or more credit hours per semester. For students enrolled in less than twelve credit hours, tuition is charged on a per-credit-hour basis.

University Housing Plan

A variety of living arrangements are available. The university provides housing for approximately 3,000 students on campus in a wide selection of residence facilities and approximately 550 students in fraternity and sorority housing. The housing arrangements are grouped within four basic categories, with rates associated with the category level. First and second year students are required to reside in university housing. Second year students may choose residence hall or Greek housing options.

University Meal Plan

Eight meal plans are available. First year residents are required to participate in the Category 1A Meal Plan or one of the Category I Meal Plans. Upper-class students living in a traditional or suite-style residence hall are required to participate in the Category 1A Meal Plan or one of the Category I or II Meal Plans. Students residing in a fraternity or sorority are expected to participate in their house meal plan but also have the option to choose any of the university plans offered. Students residing in campus apartments or any off-campus facilities are not required to participate in a meal plan but have the option to choose any of the plans offered.

Most meal plan includes Dining Dollars. This pre-paid declining balance account was designed for maximum flexibility and convenience and can be used at most dining locations on campus to further increase your purchasing options.

Cost of Attendance

Tuition, Room, and Board charges are listed for the academic year (fall and spring semesters) with one-half charged for each semester. Other Fees are typically charged per occurrence.

Tuition, 2024-2025	$63,930
Technology Fee	$560
Student Activity Fee	$270
Wellness Fee	$220
University Housing	
Category I (Dravo, Drinker, Centennial I & II, McClinticMarshall, Richards, Taylor)	$10,120
Category II (All Greek Houses, Houses 87, 88, 89, 90, 93, 97, UMOJA, Warren Square)	$10,840
Category III (Brodhead House, Singleton, Hitch, Maida, Trembley Park Suite Singles)	$11,250
Category IV (Farrington Square, Sayre Park Village, Trembley Park)	$11,770

NOTE: The above University Housing rates are based on multiple occupancy.

MEAL PLANS

The number of meals specified is per semester.

Carte Blanche including $200 Dining Dollars	$7,800
225 Block Plan any 225 meals per semester including $600 Dining Dollars	$7,100
200 Block Plan any 200 meals per semester including $700 Dining Dollars	$7,100
150 Block Plan any 150 meals per semester including $300 Dining Dollars)	$6,230
125 Block Plan any 125 meals per semester including $500 Dining Dollars	$6,230
75 Block Plan any 75 meals per semester including $500 Dining Dollars)	$3,780
50 Block Plan any 50 meals per semester including $500 Dining Dollars)	$2,960
The Dining Dollars $1,000 Dining Dollars)	$1,000

Based upon the above charges, most first-year students are normally billed the tuition rate, technology fee, student activity fee and wellness fee along with the Category I room fee and a Category I meal plan. The total cost for the four areas would be $82,200 for the 2024-25 academic year.

OTHER FEES

(applied to prevailing circumstances)

Tuition charge per credit for part-time status or audit	$2,660
Engineering and Science Fee per year (for specified students)	$830
Course Materials Fee	$750
Application fee (for undergraduate admission consideration)	$75
Late pre-registration (assigned to all fulltime students who do not select their full class load during the designated period each term)	$100
Late registration	$100
Late application for degree	$50
Examination makeup (after first scheduled makeup)	$25
Late payment (after announced date)	$200
Returned check fine	$35
Key/lock change (lost or non-return), room door, residence halls/sorority	$75
Identification card (replacement)	$30

The university reserves the right at any time to amend or add charges and fees, as appropriate, to meet current requirements.

OTHER EXPENSES

A student should plan to meet various other expenses. If a student chooses to opt out of Learning Unlimited, these expenses may include the purchase of books and supplies from The Lehigh Store, located in Farrington Square. Beginning fall 2023, Lehigh will be piloting a new course materials program, Learning Unlimited, that will reduce the cost of course materials for undergraduate students and ensure they have all their materials across all courses prior to the first day of class. This is a three-year pilot program expected to reduce the cost of course materials by approximately 50%. A student should plan allowance to handle personal and travel expenses.

Billing and Payments

Billing statements are available online for both the student and any person the student authorizes. Semester billing statements are available approximately six weeks prior to the start of each semester. Payments are due as follows: Fall semester by the first business day of August, Spring semester by the first business day of January, and all Summer and Winter Sessions five days prior to the start of classes. Students that register late may not receive an invoice before the applicable due date. Late registration does not excuse the student from satisfying financial obligations by the announced semester due dates. Students registering after the announced semester due date should be prepared to satisfy their financial obligations at the time of registration. Accounts not settled by the due date are subject to a late payment fee. Students that have not satisfied their financial

obligations by the payment due date are subject to having their registration revoked.

Persons desiring a payment plan can elect participation in the university's educational payment plan which provides for the payment of tuition, room, and board over four payments per semester. Deadlines to participate are the first business day of August for Fall Semester and the first business day of January for Spring Semester.

Students attending the university under a provision with a state board of assistance or with financial aid from other outside agencies must provide complete information to the Bursar's Office if assistance is to be recognized to avoid late payment fees.

Students Receiving Veteran's Benefits

Note: A Covered Individual is any individual who is entitled to educational assistance under chapter 31, Vocational Rehabilitation and Employment, or chapter 33, Post-9/11 GI Bill benefits.

Any Covered Individual may attend or participate in the course of education during the period beginning on the date on which the individual provides to Lehigh University a certificate of eligibility for entitlement to educational assistance under chapter 31 or 33 (a certificate of eligibility can also include a Statement of Benefits obtained from the Department of Veterans Affairs (VA) website e-Benefits, or a VAF 28-1905 form for chapter 31 authorization purposes) and ending on the earlier of the following dates:

- The date on which payment from VA is made to the institution
- 90 days after the date the institution certified tuition and fees following the receipt of the certificate of eligibility.

Lehigh University will not impose any penalty, including the assessment of late fees, the denial of access to classes, libraries or other institutional facilities or the requirement that a covered individual borrow additional funds, due to the delayed disbursement funding from VA under chapter 31 or 33.

Refunds of Charges

TUITION AND ACADEMIC FEES

An undergraduate student in good standing who formally withdraws or reduces his or her course enrollment below twelve credit hours before 60% of the semester has been completed during the fall and spring semesters will be eligible for a tuition refund. An undergraduate student in good standing who formally withdraws or reduces his or her course enrollment before 60% of a session has been completed during the summer sessions will be eligible for a tuition refund.

A graduate student in good standing who formally withdraws or reduces his or her course enrollment before 60% of the semester has been completed during any semester will be eligible for a tuition refund.

The tuition refund for a student who withdraws or drops a course(s) is calculated on a daily basis. No refunds for tuition can be made for courses or workshops with five class sessions or less after the first day of class. Additional penalties may apply to withdraw from special programs or courses held at off-campus locations, such as Study Abroad or Geology Field Camp.

The date used to calculate refunds is based on when a properly authorized withdrawal or drop/add is received by the Office of the Registrar.

Academic fees (such as Technology Fee, Engineering and Science Fee, course associated fees, etc.) are non-refundable after the first day of classes.

In the event of a medical withdrawal or death of a student, certified by the Dean of Students, tuition will be refunded in proportion to the semester remaining.

Tuition Credit/Refund for a Disciplinary Suspension or Expulsion

A student who is suspended from the University during the semester in which the incident occurred is eligible for a tuition credit that will be applied to the semester immediately following the period of suspension. The amount of tuition credited will be based upon the tuition refund schedule for a voluntary withdrawal and the tuition rate in effect during the semester in which the incident occurred less any required financial aid adjustments and any outstanding balance on the student's account. The date used to calculate the tuition credit will be the date that the disciplinary process (including any appeals) is finalized and communicated in writing to the student. For cases in which a student is placed on interim suspension and prohibited from being on campus or attending classes, the tuition credit will be calculated using the interim suspension date. Tuition credit not utilized in the semester immediately following the period of suspension is forfeited.

A student who is *expelled* from the University forfeits all payments for tuition and fees incurred for the semester the incident occurred.

If the decision to suspend or expel a student is made in a semester subsequent to the semester in which the incident occurred, the student is eligible to receive a 100% tuition refund less any required financial aid adjustments and less any outstanding balance on the student's account not related to the current semester of instruction. Refunds will not be distributed until all disciplinary procedures including the appeals process are complete.

The University may, in its sole discretion, place a hold on the student's academic records at the time of the incident, which will limit access to transcripts and other educational records until the disciplinary process is complete.

Please note that financial aid is not guaranteed for students who exceed 8 semesters of enrollment because of a disciplinary suspension.

REFUND SPECIFICS

Credit balances resulting from an overpayment with a bank card are eligible to be refunded as a credit transaction to the bank card by contacting the Bursar's Office.

Credit balances resulting from an overpayment with a check drawn on a domestic bank require a minimum two week waiting period before a refund check will be issued.

Credit balances resulting from loans, grants, scholarships, and other forms of financial aid are eligible for refund after the 10th day of class.

All refund checks will be payable to the student unless

1. the student has authorized in writing a parent or guardian listed in the Banner Student System to receive the refund, or
2. the check payment on the account was clear that the payment was from an unrelated organization or institution, such as a sponsoring corporation.
3. the student has a parent plus loan and the funds are due back to the parent.

Refunds will be processed as an ACH deposit to the student's bank account. In order to process these via ACH, students will need to create a Refund Profile in the eBill Suite. Students who do not have a Refund Profile set up will receive a check mailed to the student's university post office address or, if none, to the student's "home address" listed in the Banner Student System. Any exception to this policy must be authorized in writing by the student.

Students receiving financial aid that drop below full time status must have their financial aid package re-evaluated by the Office of Financial Aid prior to the issuance of any refund check.

RESIDENCE HALL/HOUSING REFUNDS

Residence hall rooms are rented on an annual basis only. A student who signs a housing contract is expected to reside in and be financially responsible for residence hall housing for both the fall and spring semesters of the specific academic year for which the contract was signed. A student who forfeits a housing reservation and who returns to the university at any time during the contracted academic year is still obligated for housing charges if vacancy in the residence hall facilities exists and without regard to location.

Prior to registration, housing rental refunds are made in full in the event a student does not register because of illness or injury; is dropped from the university due to academic reasons; attends a university-approved study abroad or co-op program; graduates; or

voluntarily withdraws from the university. After registration, prorated housing rental refunds are granted for the same reasons. Prorated refunds are based upon the date the room has been vacated, belongings are removed, and the room key is returned to the Office of Housing Services. Any student suspended or expelled from housing or the university will not be granted any housing rental refund.

UNIVERSITY MEAL PLAN REFUNDS

Meal plan refunds are made in full in the event a student does not register and has not purchased any meals from the plan.

After registration, a student who purchases meals on the plan but withdraws from the university will receive a pro-rata meal plan refund based on the date of the last use or number of meals remaining depending on the meal plan chosen. The Dining Dollar portion is non-refundable.

Any student suspended or expelled from housing or the university will not be granted a meal plan refund.

Meal plans may be changed within the requirements of the living area up to the tenth day of class each semester on line with charges assessed per an established proration schedule.

After the tenth day of class, a student who wishes to change a meal plan must petition and receive approval from Auxiliary Services for Housing, Dining and Conference Services. If the change is approved, an adjustment will be processed on a pro-rata basis to the meal portion of the plan charge as of the week following the last meal purchased.

ADJUSTMENTS TO FINANCIAL AID

The Office of Financial Aid is responsible for determining the appropriate redistribution of charges and refunds when students receive any financial assistance. These decisions are made on the basis of federal, state and institutional policies. Any refunds due to the Title IV programs will be refunded in the following order:

Federal Direct Unsubsidized Stafford Loan
Federal Direct Subsidized Stafford Loan
Federal Perkins Loan
Direct PLUS Loan
Federal Pell Grant
Federal SEOG
Any other Title IV program

Financial Aid

The mission of the Office of Financial Aid is to reduce the financial barriers to a Lehigh education for those families whose resources alone would make it impossible to meet the cost of attendance.

Our aid program is designed to measure the difference between our costs and the amount of money your family can be expected to contribute towards those costs. That difference is called “financial need” and represents financial aid eligibility. The majority of Lehigh’s funds are awarded on the basis of financial need. Students must file on time and meet academic progress requirements to be eligible for consideration.

The basic components of financial aid consist of gift aid (grants and scholarships) and self help (employment and loan assistance). Gift aid is generally not repayable. The majority are awarded on the basis of “need” and are renewable on the basis of continuing “need”, satisfactory academic progress criteria and on time filing. Employment provides money for books and personal expenses, and is paid through biweekly payroll checks based on hours worked. Loans are repayable funds from one or more sources, repayable after the student ceases to be enrolled on at least a halftime basis.

Additional sources of aid include, but are not limited to: state agencies, employers, and various clubs, churches, religious and fraternal organizations, and foundations. High school guidance counselors are able to provide information about local aid programs.

For more detailed information, please visit the financial aid office website at www.lehigh.edu/financialaid. (http://www.lehigh.edu/financialaid/)

Application Procedures

APPLICATION PROCEDURES

Students who are applying for institutional need-based aid are required to submit the Free Application for Federal Student Aid (http://catalog.lehigh.edu/informationofgeneralinterest/financialaid/applicationprocedures/www.fafsa.gov) (FAFSA (https://studentaid.gov/h/apply-for-aid/fafsa/)), the College Scholarship Service (CSS) Profile (https://cssprofile.collegeboard.org/) (submit a separate CSS Profile for each parent if legal parents are not married and do not live together) and Federal tax forms (student, parent and business tax returns if applicable). For more detailed information such as deadlines and links to forms, please visit the financial aid website at www.lehigh.edu/financialaid (http://www.lehigh.edu/financialaid/).

INTERNATIONAL CANDIDATES

International students may be eligible for university-funded financial aid. Opportunities are limited. International applicants who are applying for financial aid must submit the College Scholarship Service (CSS) Profile (https://cssprofile.collegeboard.org/). International students who do not receive financial aid as a first year student are not eligible for aid in future semesters.

RENEWAL OF AID

Financial need is reviewed annually to ensure aid eligibility as determined by the Office of Financial Aid, in conjunction with federal, state and university guidelines, reflects current financial and household information. In order to maintain federal and institutional grant eligibility from one academic year to the next, students must continue to demonstrate financial need. Changes in circumstances such as sibling(s) enrollment in undergraduate college, changes in household size or changes in income may result in a change in financial aid eligibility. For more detailed information such as deadlines and links to forms, please visit the financial aid website at www.lehigh.edu/financialaid (http://www.lehigh.edu/financialaid/).

All students receiving financial aid must maintain satisfactory academic progress. Satisfactory academic progress for Federal financial aid eligibility differs from the academic progress policy for institutional aid. To maintain eligibility for Federal aid, students are expected to maintain satisfactory academic progress based on both qualitative (cumulative GPA) and quantitative standards (pace of progression). Students must achieve a minimum cumulative GPA of a 1.70 after their freshman year (earning between 0 and 22 credits) and a minimum cumulative GPA of 2.0 for all other grade levels (23 credits and above). Per Federal Guidelines, students have a maximum of 12 semesters of Federal Aid to complete their graduate requirements (aggregate loan limits apply as well). Students must successfully complete a minimum of 67% of their attempted coursework.

In order to maintain eligibility for Institutional financial aid, students must 1.) Earn 12 new credits each semester, 2.) Earn a minimum grade point average of 2.0 for each semester, and 3.) Maintain a minimum cumulative grade point average of 2.0. Eligibility for institutional aid at Lehigh University is limited to Undergraduate enrollment in 8 consecutive semesters (unless you are enrolled in IBE, IDEAS or Art Engineering). NOTE: Institutional aid is provided to assist students in obtaining a bachelor’s degree. Additional aid will not be available to students who choose to enhance their bachelor’s degree with additional credentials (ie. second major/minors) and are unable to do so during the 8 consecutive semesters.

For both Federal and Institutional aid purposes, academic progress will be checked annually, at the end of each payment period, unless a student is on Financial Aid Probation, in which case SAP will be checked at the end of each semester.

Sources of University Aid

Several forms of university-funded aid, based on need and merit, are available.

LEHIGH UNIVERSITY GRANTS [ENDOWED AND SPONSORED SCHOLARSHIPS]

Lehigh Grants are need-based awards funded through university funds and endowments established by generous alumni and friends of the university. The general Lehigh Grant fund is originally awarded

to act as a “placeholder” until we are notified of the amounts we are able to award for each of the named scholarship funds. The general Lehigh Grant may be swapped with an endowed or sponsored Lehigh scholarship, established by a donor.

LEHIGH UNIVERSITY MERIT SCHOLARSHIPS

Merit-based awards are gift aid awarded to students solely on a merit basis. When awarding merit aid, we take a holistic approach, looking beyond the numbers related to academic talent alone and reviewing what a student contributes outside the classroom as well as considering recommendations and personal essays. Selection for Lehigh merit-scholarship recipients is made by the Admissions Office -- all students are considered for these awards during review of admission applications. Merit awards can be given in the amounts of full-tuition (Founders Scholarship), half-tuition (Trustees Scholarship) and $15,000 (Deans Scholarship). Awards are renewable for four years of undergraduate study and require a 3.0 average and satisfactory progress toward a Lehigh degree.

CUTLER-SAMETZ CHORAL ARTS SCHOLARSHIPS

Several merit scholarships of $5,000 are available for gifted students in the Choral Arts who maintain at least a 2.8 grade point average. Talented singers are eligible for these scholarships, renewable for four years, and recipients also receive free vocal lessons. Scholars are expected to join the University Choir. A separate application from the music department is required.

SNYDER FAMILY MARCHING SCHOLARSHIPS

Established by alumnus Joseph Snyder and family, these scholarships are for students who demonstrate musical talent and leadership skills. The scholarship provides awards of $1,500. Recipients of this scholarship agree to participate fully in the Marching Band. Recipients must maintain at least a 2.8 grade point average. A separate application is required

PERFORMING ARTS SCHOLARSHIPS

Open to students in any academic major or program, these scholarships recognize students with exceptional musical and theatrical (including performance, design, technical, and playwriting) talent. These scholarships are valued at $3,000 and $5,000 and are renewable for four years. Recipients must maintain at least a 2.8 grade point average and remain active in the performing arts at Lehigh. A separate application is required.

ARMY ROTC LEADERSHIP AWARDS

In certain instances, the university may supplement an Army ROTC scholarship with a leadership award that is equal to the cost of room and board. These are highly competitive and require a 2.5 average for renewal.

NATIONAL MERIT SCHOLARSHIP CORPORATION AWARDS

Lehigh is a collegiate sponsor of the National Merit Scholarship program. Scholarships valued at $2,000 per year will be awarded to Merit finalists selecting Lehigh as their first choice college, and who are not also receiving another form of National Merit scholarship.

ATHLETIC AWARDS

Athletics scholarships are available for students with exceptional athletic ability.

Availability of Jobs

Work-study jobs are available throughout the university and are funded through federal and university sources. All work-study positions are posted on Handshake. Upon securing a work study job and completing all of the necessary paperwork, you will be paid on a bi-weekly basis, as you work and submit timesheets. Work-study earnings are not deducted from your billed expenses. Visit the Office of Financial Aid for more information about the work study program (https://www2.lehigh.edu/financial-aid/work-study-program/).

The Job Locator Development Program is designed to assist you if you do not qualify under the Federal Work-Study program to find employment off-campus or with a number of incubator companies located on the Mountaintop Campus. This program is coordinated through the Office of Career Services.

Aid from the Government

Lehigh University is an eligible participant in federally funded student aid programs. Campus-based programs, where the university makes the awards based on the dollars available, include:

Federal Supplemental Educational Opportunity Grants
Federal Work Study

Direct programs (where the government directly, or through lenders for loan programs, provides the necessary funds) include:

Federal Pell Grants
Federal Direct Subsidized Loans
Federal Direct Unsubsidized Loans
Direct PLUS Loans (for graduate or professional students and parents of dependent undergraduate students)

Please visit our website at www.lehigh.edu/financialaid for more detailed information on any of these programs.

Information for All Financial Aid Applicants

The Office of Financial Aid determines your financial aid award based solely on your family’s demonstrated financial need. We consider many factors, such as your family’s income, assets, size and unusual expenses, and our program is designed to help families across the economic spectrum. Please note the following important items regarding the need-based financial aid process:

- **Family Responsibility**: Lehigh’s philosophy behind financial aid eligibility is that a student and his or her parents are first and foremost responsible for the expenses related to obtaining an undergraduate degree. Furthermore, our expectation is that *both* parents, regardless of marital status, have a responsibility to participate in the financial aid process.
- **Expected Family Contribution**: Lehigh financial aid counselors carefully review the information your family provides in the financial aid application, including any additional circumstances brought to our attention, in order to determine the Expected Family Contribution (http://www1.lehigh.edu/financialaid/glossary/), also known as the “EFC." It is important to understand that the Expected Family Contribution is not what we think a family has “left over” after other expenses have been covered, and we do not necessarily expect that the parent contribution will be paid from current income. Rather, the level of contribution reflects our analysis of what parents can afford to absorb in education costs over time. Parents may choose to provide their contribution from savings, current income, future income (through borrowing), or some combination.
- **Determining Need-Based Financial Aid Eligibility**: Need-based eligibility is calculated per academic year and is determined using the following formula:
  Cost of attendance for one academic year - calculated EFC = **financial need**
- **Merit-Based Financial Aid**: All students are considered for merit aid at the time of admission. Students who are selected to receive a merit-based scholarship will be notified when they are admitted to the University. The Office of Financial Aid does not determine eligibility for merit scholarships (academic, athletic or otherwise), and the application process described on our website is not related to these resources. View more information on Lehigh merit scholarships > (http://www1.lehigh.edu/admissions/undergrad/tuition/)

If a student has demonstrated financial need (http://www1.lehigh.edu/financialaid/glossary/), this financial need will be covered with a combination of gift-aid (http://www1.lehigh.edu/financialaid/glossary/) and self-help (http://www1.lehigh.edu/financialaid/glossary/).

Student Rights and Responsibilities

STUDENT RIGHTS

Students have the right to know

- the cost of attendance;
- the refund policy for students who withdraw;

- the financial assistance available from federal, state and institutional sources;
- procedures and deadlines for submitting applications for financial aid;
- how financial aid recipients are selected;
- how eligibility was determined, including all resources the aid office considered available to the student;
- how and when funds will be disbursed;
- an explanation of each type of award received;
- for any student loan received: the interest rate, total amount to be repaid, when repayment begins, the length of the repayment period, and the cancellation or deferment provisions of the loan;
- for any Federal Work-Study or university-funded job: a description of the job, the hours to be worked, the rate of pay, and how and when the student will be paid;
- the criteria used to determine satisfactory academic progress for financial aid purposes; and
- how to appeal a decision by the Office of Financial Aid concerning any aid award.

STUDENT RESPONSIBILITIES

It is the student's responsibility to:

- read directions thoroughly, complete all application forms accurately, and to comply with any deadlines;
- provide any supplemental information or documentation required by the Office of Financial Aid or other agency if applicable;
- read, understand, and keep copies of any forms the student is required to sign;
- repay any student loans received;
- attend an entrance interview and an exit interview if federal, state or university loans are received while in attendance at Lehigh;
- notify the Office of Financial Aid of any change in enrollment status or financial status (including any scholarships or grants received from outside sources); changes of address and enrollment status must also be reported to lender(s) for any loan(s);
- satisfactorily perform the work agreed upon in a Federal Work-Study or university-funded work program; and
- know and comply with all requirements for continuation of financial aid, including satisfactory academic progress requirements.

For additional information write to the Office of Financial Aid, Lehigh University, 27 Memorial Drive W, Bethlehem, PA 18015; telephone (610) 758-3181; FAX (610) 758-6211, email financialaid@lehigh.edu or visit our website www.lehigh.edu/financialaid (http://www.lehigh.edu/financialaid/).

Theatre

In Spring, of 1997, the Department of Theatre moved to the Zoellner Arts Center, Lehigh's impressive performing arts facility. Three theaters, scene and costume shops, a dance studio, music practice rooms, classrooms, and more enhance the department's curricular activities. The Department of Theatre's annual production program includes four productions in the three-hundred-seat Diamond Theater and multiple lab productions in the one-hundred-seat Black Box Theater. The plays range from classics to world premieres.

Shows directed and produced by students as class projects or independent work occur regularly in the Fowler Black Box Theater. Many events are sponsored by the Mustard and Cheese Drama Society, the country's second-oldest collegiate drama club.

Auditions and production crews are open to all members of the university community. Production opportunities exist in performance, choreography, set and costume construction, properties management, lighting, sound, house management, and marketing & publicity. Advanced students have opportunities to direct or design, under faculty supervision.

Incoming students with a strong passion for the performing arts can take advantage of the Lehigh University performing arts scholarship. This shcolarship provides additional financial support for students who have demonstrated exceptional talent in the areas of theatrical performance, design, and production.

Outstanding work in the Diamond or black box theaters may be recognized with Williams Prizes and theatre department prizes in acting, directing, design, playwriting, and technical production.

Professional guest artists - directors, playwrights, designers, and actors - frequently visit the Lehigh campus to work on productions, teach classes, and conduct seminars and workshops for all interested students. The department also sponsors artists-in-residence, guest lecturers, workshops, and touring performances.

For more information, visit: https://theatre.cas.lehigh.edu/

Musical Organizations

The music department offers students an array of ensembles in which to perform and develop leadership skills. The choruses, bands, orchestra, and ensembles are conducted by members of the faculty and collaboratively managed by the faculty and elected student leaders. Nearly all performances except Christmas Vespers are held in Baker Hall in the Zoellner Arts Center.

Students earn one credit per semester for each ensemble or lesson course in which they are registered, but they may register for zero credit to avoid overloading.

LEHIGH UNIVERSITY PHILHARMONIC ORCHESTRA

The Lehigh University Philharmonic Orchestra, directed by Eugene Albulescu, is a body of 60-70 players from diverse backgrounds. Though primarily a student orchestra, faculty and community members also participate, creating an ensemble that contains unique intersections between students of all majors and professionals, campus and community. Students bring the great works of orchestra repertoire to life in four pairs of concerts a year in Baker Hall, Zoellner Arts Center. Membership is by audition.

JAZZ ENSEMBLES

The Jazz program, directed by Bill Warfield, consists of a number of groups large and small, including the Jazz Ensemble, the LU Jazz Repertory Orchestra, the LU Funk Band, and a number of combos. The ensembles perform contemporary literature as well as the music of the more traditional bands such as Basie, Ellington, Goodman and Herman. A distinguished faculty of jazz musicians teaches private lessons and coaches the combos. Membership is by audition.

MARCHING 97

The Marching 97, under the direction of David Diggs, meets during the fall semester and plays at each Lehigh home game, as well as several away games. Made up of students from all of the colleges at Lehigh, the band is a student-run organization dedicated to building a positive Lehigh spirit at games and off the field. Band camp is held three days during the week prior to the start of classes. No audition is required.

SYMPHONIC BAND

The Symphonic Band, under the direction of David Diggs, meets and performs only in the spring semester of each year. The ensemble consists of students, faculty and staff who are interested in playing music. No audition is necessary.

WIND ENSEMBLE

The Wind Ensemble, under the direction of David B. Diggs, is a select group of students dedicated to performing music for woodwinds, brass and percussion. These students represent many diverse majors. In 1999 the Wind Ensemble was honored by Downbeat Magazine, receiving the award for the most outstanding college classical symphonic band.

LEHIGH UNIVERSITY CHORAL ARTS

The Lehigh University Choral Arts, co-directed by Steven Sametz and Sun Min Lee is the umbrella organization for a number of vocal ensembles:

Lehigh University Choir

The Choir is an active force in campus life. The 60 mixed voices of the Choir, drawn from all majors of the University, are auditioned at the beginning of the academic year. They give four major concerts

on campus and tour internationally. The Choir frequently performs with orchestra and regularly performs new music, including many works written especially for them. They have been heard five times on National Public Radio. The Choir has toured to Austria, China, France, Germany, Korea, Portugal, Russia, Thailand, Taiwan, and has performed in Carnegie Hall and Avery Fisher Hall at New York's Lincoln Center.

Lehigh University Choral Union

The Lehigh University Choral Union, composed of students, faculty, staff, and Lehigh Valley community members performs three times a year with internationally known soloists and a full symphony orchestra. The 200 singers of the Choral Union bring major works such as Beethoven's Ninth Symphony, Mahler's Second Symphony, and the Brahms Requiem to a broad audience. No audition is required.

LEHIGH UNIVERSITY DOLCE TREBLE CHOIR

Dolce – Lehigh University's Treble Choir under the direction of Sun Min Lee begins a new tradition of music for treble voices. They perform to enthusiastic audiences on campus, in the Bethlehem community and beyond. Dolce sings a variety of music written especially for treble voices as well as music adapted for the group. Members of Dolce also sing with the University Choir.

Lehigh University Glee Club

The recently revived Glee Club sings traditional and new music for male voices under the direction of Steven Sametz. Enthusiastically welcomed by alumni and the university community, the Glee Club has thrilled audiences on campus, on tour in China, and at Lincoln Center, where they performed with the University Choir.

Club Sports

A Club Sport is formed when a group of students voluntarily organize in the aim of seeking structured and most often competitive sport opportunities in an area of common interest. Club sports are structured and guided by the principles and obligations of other student organizations, and are not formally recognized until they are fully compliant and meet required expectations. The initiative, organizational commitment and personal investment required for club sports participation fosters an extraordinary learning and leadership experience.

Competition levels can range from Div I club Men's Ice Hockey and Men's Rowing to sports such as Cycling, Equestrian, Men's and Women's Rugby, Ultimate Frisbee, Water Polo or non competitive sports that includes Fencing and Gymnastics just to name a few. In total, there are 32 recognized club sports that are active.

Intramural Sports

Intramural sports are organized, structured, and competitive activities that are played within the University. At Lehigh, members form teams from IFC, Pan-Hellenic, off campus houses and dorms. The number of sport offerings will varies from 8 to 12 activities as time and space permits. Intramural sports offers students a high degree of physical fitness, helps establish habits of regular and healthful exercise, fosters the development of self confidence, good sportsmanship, and a spirit of cooperation.

Fitness

Lehigh's Taylor Gym is the home for indoor fitness and recreation opportunities on campus for the Lehigh community. A wide variety of fitness and wellness programs are offered, including group exercise classes taught by professional instructors who teach all over the Lehigh Valley. Our goal is to make quality fitness programming accessible and inclusive for all Lehigh community members. To learn more about our fitness programs, please visit our website (https://lehighsports.com/feature/Fitness/).

Recreation

The entire Lehigh community is invited to participate in fitness and recreational activities such as getting a workout in at the Welch Fitness Center, lap swimming in our pool, playing pickup basketball, playing squash, racquetball and ping pong or use the Lane Challenge Climbing Wall. You can also refine your dance moves in the dance studios which are all located in Taylor Gym. The annual Turkey Trot campus run which is held during our "rivalry week" is another opportunity to engage with the community. The Goodman Campus provides a vast green space, to throw a Frisbee, kick a soccer ball or play other pick up activities. You can run on our nationally known cross-country course, hit a tennis ball at the Lewis Tennis Center or drive a bucket of golf balls at the Mulvihill Golf Learning Center. The opportunities are endless! Please visit the fitness and recreation webpage (https://lehighsports.com/sports/recreation/#_ga=2.199292779477421122165166858-2513734111643052024) for more information.

Student Code of Conduct

Intellectual honesty and mutual respect are not accidental values in a university. They are, for students and professors alike, a presupposition of the pursuit of truth, which brings universities into existence. It is essential that an academic community uphold these values. The student code of conduct and the student conduct system are mechanisms by which the university endeavors to develop in all students a sense of responsibility to the Lehigh University community.

The Lehigh University Student handbook (https://studentaffairs.lehigh.edu/node/32 **(**https://studentaffairs.lehigh.edu/node/32/**)**) contains information relevant for the student members of our community. All students have an obligation to read and be familiar with the Student Handbook, the Code of Conduct **(**https://lehigh.edu/go/codeofconduct/**)**, and the other policies contained therein.

ATTENDANCE POLICY

The university assumes that regular class attendance is an essential element of its academic operations. A student is personally responsible for the academic consequences of a poor attendance record. 1) If for any reason any student is to be away from the university for an extended period of time (e.g., three consecutive class days), he or she has the responsibility of informing the Dean of Students before the absence. At the first class session after any absence or period of absence the student ascertains from the instructor what make-up work is required, and when and how it becomes due. 2) For officially approved field trips, athletic contests, or extracurricular activities, a report is provided to each instructor describing the schedule and listing the names of students authorized to participate. 3) For absences of other sorts the student should complete the student absence form (https://studentaffairs.lehigh.edu/content/leave-absence/). 4) All reports of absence are for information only and do not bind the instructor to any particular course of action. 5) If a student appears to be neglecting the work in any course or interferes with the discipline of any course, the faculty member may submit a Section 3 report to the Dean of Students, who warns the student and, upon the second report, if the faculty member requests it the student will be excluded from the course which has been neglected. If a student is excluded from two or more courses, the case is brought to the committee on standing of students for further action. 6) Make-up privileges for a student absent during any part of the three days immediately preceding or the three days immediately following Pacing Break, Thanksgiving, winter recesses, or spring recesses are denied, unless such absence is certified by the Dean of Students. 7) Each instructor informs students in each course of his or her attendance policy and the policy should be included in the syllabus. A student is responsible for observing the instructor's written interpretation as distributed for each course.

In Bethlehem, An Educational Tradition

Lehigh University shares in the historical heritage of Bethlehem, even though, having been founded in 1865, it is a relative newcomer. The fact that Lehigh was established in Bethlehem reflects the tradition of education established by the community's first settlers thirty years before the founding of the nation.

The first Moravians were among the many German religious sects that came to the New World, and especially to Pennsylvania, during the early 1700s. But unlike William Penn, who established his sylvania as a new land where he might hold his Quaker beliefs away from England's oppression, the Moravians came as missionaries with the

intent of converting the Indians to Christianity. For this purpose they settled the Lehigh Valley.

The early Moravians were industrious. Their first building, the Gemein Haus (community house) was completed in 1741. This building stands today, one of thirty-nine remarkably preserved pre-Revolutionary War buildings constructed by the Moravian settlers and in continuous use ever since by the Moravian community. Many of these buildings are located on Church St., west of the City Center; industrial buildings are located in the 18th Century Industrial Area in the Monocacy Creek valley west of the business district.

The leader of the Moravians was Count Nicholas von Zinzendorf of Dresden. He arrived in the settlement in time for their observance of Christmas Eve in 1741 and gave the settlement the name Bethlehem —"house of bread".

The settlers built high-quality structures of stone, demonstrating principles of engineering that were not generally used elsewhere. They were interested in music, and established the first symphony orchestra in America. In 1748, the settlement had a fourteen-man orchestra. The community's first organ was built in 1757 by John Gottlob Klemm. The musical tradition, including the trombone choir, continues today, perhaps most visibly in the Bach Choir of Bethlehem, whose yearly Bach Festival is held in the university's Packer Memorial Church. In 1985, the 300th anniversary of the birth of Johann Sebastian Bach was observed.

Zinzendorf envisioned Bethlehem as the center for manufacturing; outlying Moravian settlements, such as Nazareth, Pa., would be primarily devoted to agriculture. On October 15, 1742, a large barn was "raised" with the help of most of the residents. Three months later a grist mill at the community spring produced the first flour. In 1758, the Sun Inn was built along Main St., a haven for travelers. Reconstruction of the picturesque inn was completed in 1982, and it now operates as a community center and restaurant.

Zinzendorf's determination that Bethlehem would be a major industrial center was assisted by the completion in 1755 of the water works, the first public utility in the New World.

The Moravian dedication to education was an extension of the philosophy of John Amos Comenius, who had written, "Everyone ought to receive a universal education." The Moravian educational institutions that continue today, including Moravian Academy and Moravian College, stem from this tradition.

The Moravians, although avowedly opposed to war, found their community pressed into service as a hospital when Washington's troops bivouacked at Valley Forge during the winter of 1777-78. Washington came to the community once, and many other Continental Army officers were visitors.

The Sun Inn was also used as a hospital during the war; among its patients was an aristocratic renegade from France, Marie Joseph Paul Ives Gilbert Motier, the Marquis de la Fayette. Lafayette had come to assist the Continental Army aboard his own ship, the "Victory." Fifty years later a college in Easton was named in his honor and it became Lehigh's traditional football rival.

The first bridge across the Lehigh River was built in 1794. It was replaced in 1816, but the latter was destroyed by a flood in 1841. In 1759, the turnpike (toll road) over South Mountain, generally along the route of the present Wyandotte St. hill, was opened. The present Hill-to-Hill Bridge was built some fifty years ago.

"Black gold." During the late 18th century, anthracite was found in the mountains north of the Lehigh Valley. In 1818, the Lehigh Coal Co. and the Lehigh Navigation Co. were formed, one to mine the anthracite on the upper Lehigh River, the other to transport it down river to metropolitan markets.

The Lehigh River was difficult to navigate. Consequently, in 1829 the Lehigh Canal was completed from Mauch Chunk (now Jim Thorpe), through Bethlehem to Easton, where it connected with the Delaware Canal. During the 1840s, iron mines were opened in the area, and several blast furnaces, fueled by coal, were in operation. Zinc ore, was found in neighboring Upper Saucon Township. In the 1850s Asa Packer built the Lehigh Valley Railroad. These origins eventually led to the heavy industry that continues in the Lehigh Valley today.

When Asa Packer founded Lehigh University in 1865, one of his objectives was to make possible broadly based education for young people of the region, combining the technical skills needed to run the flourishing industry of the Lehigh Valley with a liberal education.

In addition to its role as a steel-making center, Bethlehem today is a major tourist attraction. The Moravian community sets up an elaborate nativity scene and the entire city is decorated with lighting during the holiday period. The Moravian tradition of a single candle (now electric) in each window is widely observed.

Atop South Mountain is a steel tower known as the Star of Bethlehem. During the holiday period, the star's hundreds of bulbs create a 95-foot-high star that can be seen for many miles. The star was the gift to the community of Marion Brown Grace, wife of Eugene Gifford Grace, the steel magnate and president of the university board of trustees.

The community of Bethlehem has a population of approximately 78,000 persons with segments from a variety of nations who retain traditions of their country of origin.

There are five principal independent colleges in the Lehigh Valley besides Lehigh. They are Lafayette, DeSales University, Moravian, Muhlenberg, and Cedar Crest. A cooperative program is maintained that allows cross-registration for courses as well as shared cultural events. There are also two community colleges in the area.

In August 1984, Bethlehem held its first Musikfest, a 10-day annual festival that features a variety of musical performances and ethnic foods. An instant success, Musikfest was the brainchild of Jeffrey A. Parks, a lawyer and 1970 Lehigh graduate.

University Resources

Lehigh University offers a variety of resources to support the campus community as noted in the menu to the left.

Library and Technology Services

The ever-increasing sophistication of information technology offers new and exciting opportunities for enhancing teaching, learning, research, and administrative operations at Lehigh. To capitalize on these new opportunities, one merged organization called Library and Technology Services (LTS) provides classroom and communications technologies, digital and print library materials, digital scholarship services, computing resources, online education support, enterprise systems implementation, professional development programming, instructional technology, information security, and media services. Additional information about Library and Technology Services can be found at lts.lehigh.edu (https://lts.lehigh.edu/).

Libraries

Lehigh University has two major library facilities, Linderman Library and Fairchild-Martindale Library, plus a Library Materials Center (LMC) on Mountaintop Campus.

The historic Linderman Library is a showcase for Lehigh's history and heritage and includes much of our Humanities and Art collections. Its world-renowned 1878 high Victorian rotunda and 1929 grand reading room have long conveyed magnificence. A major renovation in 2005 and more recent updates in 2022 provide additional seminar rooms, research spaces, group study rooms, high-speed wireless throughout the building, and the popular Lucy's Cafe.

Linderman Library houses Lehigh Libraries' Special Collections with an impressive collection of rare books, including Darwin's On the Origin of Species and John James Audubon's double elephant folio edition of Birds of America as well as deep heritage collections which represent the intellectual and administrative life of the Lehigh campus from its foundation. Researchers can have hands-on experience with these materials by appointment. Lehigh Libraries has an extensive digitization program and supports an open access repository, readily available for faculty, student, and community-based research.

The modern and dynamic Fairchild-Martindale Library offers immersive and collaborative learning spaces, experimental classrooms, areas for individual or group work or study, and The Grind@FML cafe as well as a recently renovated art exhibition gallery. In 2023 the library opened the LTS CIRCLE (Community & Inclusion Resource Center: A Library for Everyone), a space to support inclusivity and diversity across the campus and as a bridge to connect people and ideas with resources in a shared, inclusive space. The Fairchild-Martindale Library holds print books and journals in all branches of science, engineering, mathematics, and the social sciences, including business and education, as well as a leisure reading collection.

Fairchild-Martindale Library is also home to the Center for Innovation in Teaching and Learning (CITL). CITL spaces in the library include two technology classrooms outfitted for flexible and collaborative learning, the DIY video production studio, the Data Visualization Lab, the Student Developer Lab, a TRAC Writing Fellows consultation area, and the Digital Media Studio classroom.

The Lehigh Libraries offer students, faculty, and staff an extensive range of electronic journals, electronic books, and full text and image databases easily accessible from on and off campus. The Libraries optimize network-level collaborations between research libraries in Pennsylvania and neighboring states to maximize access and availability of resources to Lehigh users.

Organizationally, the Libraries are part of Library and Technology Services. The LTS Help Desk staff, technology specialists, and subject librarians provide personalized service, partner with faculty on teaching and research projects, and offer research seminars, workshops, and classes to the Lehigh community.

Computing

Providing technology and consulting services to support classroom teaching, laboratories, and other aspects of the academic and research programs is a strategic priority for Lehigh University. Over 570 LTS-supported Macs and Windows devices are distributed across campus in over 35 computing sites and 100 classrooms.

Students and faculty have access to site-licensed software applications and central and cloud-based file storage from on and off campus. LTS provides software at public computing sites for general word processing and spreadsheets, mathematical and statistical packages, and specialized applications for scientific and engineering work. Over 60 software titles are also available in a virtual environment through the LUapps service.

Lehigh provides access to two high performance computing clusters for large scale scientific computing and a Ceph-based data storage cluster. These provide 6,916 computing cores with 50TB total memory, 229 GPU devices, and 2026TB raw storage available to tackle the most complex and demanding research projects. For more information, see Research Computing (https://lts.lehigh.edu/research-teaching-learning/research-computing/). University computing capacity and Internet bandwidth are continuously being increased to meet escalating demand.

The Center for Innovation in Teaching and Learning supports faculty innovation -- see the Faculty Development section of this catalog for details. Library and Technology Services provides technical support for the many computer classrooms, suitable for individual hands-on instruction. Most Lehigh University classrooms are equipped with permanently-installed computer projection systems. Equipment is available through the Digital Media Studio to enable faculty or students to give computer-based presentations in any space.

Lehigh deploys more than 4,200 Wireless Access Points throughout campus, including student housing, to provide the best wireless experience for teaching and learning, and social activities. In addition, the campus is connected to 3 regional diversified 10Gbps Internet Service Providers (ISPs) for performance and redundancy.

Media Services

Library and Technology Services offers an extensive media collection and streaming video services for courses. Videos and DVDs are available for viewing and for short-term loan at the Fairchild-Martindale Library.

The Digital Research and Scholarship Team is part of the Library and Technology Services Center for Innovation in Teaching and Learning. The team works with faculty and students in the use of digital tools and technologies that enable them to develop and/or disseminate their coursework and research. Examples of work include documentary audio and video, web publication, and spatial and data visualization. The Digital Media Studio (https://lts.lehigh.edu/space/digital-media-studio/), located in the Fairchild-Martindale Library breezeway, houses resources for professional audio and video recording and a Mac computer lab and classroom, equipped with basic and advanced video editing and design software. The lab also loans video, audio, and photography equipment.

Students, faculty, and staff can create high-quality video recordings at the touch of a button, and without any previous video production experience, in two DIY Video Recording Studios, one located on the 5th floor of Fairchild-Martindale Library (https://lehigh.atlassian.net/wiki/spaces/LKB/pages/26690701/DIY+Video+Recording+Lightboard+Studio+EWFM+522A/), and the other in Building C on Mountaintop Campus (https://lehigh.atlassian.net/wiki/spaces/LKB/pages/26684111/DIY+Video+Recording+Studio+Building+C/). Building C also includes an Audio Recording Studio (https://lehigh.atlassian.net/wiki/spaces/LKB/pages/26678149/Audio+Recording+Studio+Building+C/), where users can easily record quality narrations, voiceovers, interviews and podcasts on their own.

Student Services

The LTS Help Desk provides library and technology assistance to the Lehigh community via walk-up, phone, email, text, and chat. The Help Desk is open during business hours as well as evenings and weekends to assist with computing, networking, software, library research, and more. Students can borrow laptops (short and long-term) and chargers here.

Student Technology and Repair Services (STARS) provides technical consulting on student personal devices, including virus removal, hardware/software troubleshooting, data recovery, and operating system issues. STARS is open Monday through Friday, with daytime and evening hours. Devices with hardware issues can be transferred to the LTS Computing Repair Service (CRS). CRS has certified hardware repair technicians on site to assist with business class Apple, Lenovo, and Dell devices.

The libraries and most computing facilities are open seven days per week and for evening hours during the fall and spring semesters. The computing center is open 24 hours during fall and spring. During final exams, the Fairchild-Martindale Library is open around the clock. Library and Technology Services maintains a variety of facilities for printing and scanning within the constraints of copyright. In the libraries are public scanners and microform readers that support image capture to network or portable drives. The Digital Media Studio assists with video and audio production. There are printers in the libraries and at most computing sites.

Each semester Library and Technology Services offers seminars and course-based instructional sessions. Participants learn how to use software applications, library resources, and software applications of all kinds. LTS professionals work closely with faculty to integrate library, computing, and media resources into the curriculum. They facilitate the use of course management software, online courses of various kinds, and course projects in a wide range of disciplines using interactive websites created by faculty and students.

Through seminars and policies on the use of print and electronic resources, students also learn computer and information ethics and safe computing practices.

Student Employment

Student assistants are essential for the operation of Library and Technology Services functions. We provide hundreds of undergraduate and graduate students with real-world, hands-on opportunities to explore their areas of interest, discover their passions, and build professional skills that complement classroom learning.

Student employees gain and develop a broad range of competencies including programming, computing and networking, scholarly research and digitization, as well as leadership, problem-solving, customer service, collaboration, and communication skills. Students can learn more about work opportunities at the job fair, held each fall, and on the LTS Student Employment webpage (https://lts.lehigh.edu/lts-student-employment-opportunities/).

Lehigh University Art Galleries (LUAG)

Lehigh University Art Galleries (LUAG), founded in 1926, holds a collection of over 19,000 artworks from diverse time periods and cultures. Located in six galleries across all three campuses, with over 50 outdoor sculptures, LUAG is one of the most extensive university art collections in the region. Exhibitions feature a wide range of artists and topics, and education programs and events range from lectures and symposia to hands-on artmaking and student-led workshops.

Opportunities for students abound at LUAG, and involve both undergraduate and graduate students from all majors and colleges. LUAG has an active Student Advisory Committee that designs and implements programs and provides critical feedback to the museum staff. Internships, work-study positions, and volunteer opportunities are available so that students can gain valuable experiential learning and learn more about careers in museums. Students are regularly involved in co-curating exhibitions, facilitating programs and leading tours in the galleries, and even assisting with collections management and art conservation. A minor in Museum Studies is offered at Lehigh through the Department of Art, Architecture and Design, and students learn side-by-side with professional museum staff. To learn more about LUAG, visit www.luag.org (http://www.luag.org/).

Faculty Development

The Center for Innovation in Teaching and Learning fosters excellence in teaching and learning by providing faculty with tools, development opportunities, workshops, and consultation services.

Faculty looking for consultation or support in any of the following areas are encouraged to contact the CITL: course design; active or collaborative learning pedagogies; instructional approaches in new course contexts; instructional media or technology; online or hybrid teaching; writing assignment design; digital scholarship for research or teaching; peer-to-peer learning; instructor presentation skills; student communication skills.

Peggy Kane, Director of the Center for Innovation in Teaching and Learning, may be contacted at 610-758-6952 or make@lehigh.edu. The CITL website is https://lts.lehigh.edu/citl (https://lts.lehigh.edu/citl/). The Writing Across the Curriculum website is https://lts.lehigh.edu/research-teaching-learning/writing-across-curriculum (https://lts.lehigh.edu/research-teaching-learning/writing-across-curriculum/)

Lehigh University Press

Lehigh University Press represents a clear expression of faculty and institutional commitment to the advancement of scholarship. Press management rests with a Director, Katherine Crassons (English), and with an Editorial Board comprised of university faculty.

The Press is interested in all fine scholarship and has six series: Critical Conversations in Horror Studies, Studies in Eighteenth-Century America and the Atlantic World; Studies in Christianity in China; Perspectives on Edgar Allan Poe; Studies in Text and Print Culture; Studies in Health Humanities . By linking the name of the university to a list of exemplary work by scholars across the nation, the Press reinforces the value of excellence in scholarship for faculty, graduate, and undergraduate students alike. Publications by the Press have won national awards, including Patricia D'Antonio, *Founding Friends: Families, Staff, and Patients at the Friends Asylum* in Early Nineteenth-Century Philadelphia (2006: The American Journal of Nursing's Book of the Year) and Sarah Fatherly, *Gentlewomen and Learned Ladies: Women and Elite Formation in Eighteenth-Century Philadelphia* (2010: The Philip S. Klein Prize for the best book on a topic that illuminates the history of Pennsylvania). Most recently, Frances Love Froidevaux and Barbara Love's *Life on Muskrat Creek* was the sole finalist for the 2019 Willa Literary Award in the Scholarly Nonfiction category from Women Writing the West.

For more information, contact:

Lehigh University Press
Linderman Library
30 Library Drive
Bethlehem, PA 18015
Phone: 610-758-3933
Fax: 610-758-6331

Email: inlup@lehigh.edu
Website: https://lupress.lehigh.edu/

Resources for Students

The Student Affairs division is dedicated to fostering student success by providing a balanced, rich and integrated living and learning environment. Virtually every student enrolled is touched by Student Affairs, beginning with orientation through the Office of First-Year Experience, and continuing through programs devoted to leadership development, community service, residential life, activities, academic support, a vibrant campus life and diversity and inclusion programs. Students are supported through the Health and Wellness Center and Counseling and Psychological Services which collectively work to ensure a safe and healthy living environment. I encourage you to visit our departmental websites to learn more about each of these areas.

To learn more about all the resources for students Lehigh University please view the following:

Student Handbook Resources http://studentaffairs.lehigh.edu/content/university-resources (http://studentaffairs.lehigh.edu/content/university-resources/)

Student Affairs http://studentaffairs.lehigh.edu/

Dean of Students http://studentaffairs.lehigh.edu/dos (http://studentaffairs.lehigh.edu/dos/)

Counseling and Psychological Services http://studentaffairs.lehigh.edu/counseling (http://studentaffairs.lehigh.edu/counseling/)

Health and Wellness Center http://studentaffairs.lehigh.edu/health (http://studentaffairs.lehigh.edu/health/)

Lehigh University Police Department https://police.lehigh.edu/

DISABILITY SUPPORT SERVICES

Disability Support Services, in the Dean of Students Office, supports and enhances Lehigh University's educational mission and its commitment to maintaining an inclusive and equitable community by providing equal access and reasonable accommodations to qualified students with disabilities in accordance with the Americans with Disabilities Act as amended (ADAAA) and Section 504 of the Rehabilitation Act of 1973.

Services for students with documented disabilities are coordinated by Disability Support Services (610-758-4152), often in conjunction with various other campus departments such as Residential Services, Facilities Services, and Transportation and Parking Services. Students requesting accommodations must present the University with current and comprehensive documentation. For more information refer to our website at: http://studentaffairs.lehigh.edu/disabilities (http://studentaffairs.lehigh.edu/disabilities/)

HEALTH & WELLNESS CENTER

Lehigh University offers health services to all (matriculating) students at the Health & Wellness Center (HWC) located in Johnson Hall. Health care providers, including nurses, and nurse practitioners and physicians, see patients by appointment Monday to Friday from 8:15-4:45. Our providers are also available for phone consultation after hours and on weekends.

The providers at the HWC treat a variety of illnesses , injuries and medical conditions. Gynecologic care is available daily for both preventative care services and treatment. Allergy immunotherapy injections are also administered at the HWC . Many lab tests are run at the HWC and phlebotomy services are available on certain days. Students can be easily referred off campus for x-rays and consultations with medical and surgical specialists. More seriously ill students can be sent to either of our local hospital Emergency Departments.

Incoming students must comply with University immunization requirements. A university sponsored health insurance plan is available which complements the services of the HWC. Families are urged to review their existing insurance coverage and limitations and to consider purchasing the university sponsored plan. Students should carry their insurance cards with them at all times.

Most services performed at the HWC are without charge. For more detailed information about this and other things, please consult our web page at www.lehigh.edu/health (http://www.lehigh.edu/health/).

Counseling and Psychological Service

The University Counseling and Psychological Service, at 610-758-3880, is located on the fourth floor of Johnson Hall. The office is open from 8:00 - 5:00, Monday through Friday with reception service available from 8:15am to 4:45pm. Most services are free of charge. Counselors are available for 24-hour emergency consultations (see Crisis Intervention below).

1. Philosophy & Mission
   The University Counseling and Psychological Service (UCPS) is dedicated to the belief that a person's college years are a time of challenge, inquiry, experimentation, productivity and change. Services are designed to help students not only manage crises, but to thrive in meaningful ways . . to grow in self-understanding in order to make more satisfying and better use of their personal and interpersonal resources. Individual contacts, group therapy, faculty and staff consultation, and numerous outreach activities are some of the primary means by which the mission is accomplished. UCPS staff members are committed to providing assistance to all registered Lehigh students interested in personal, social, and academic growth and discovery, and to serving the larger campus community through consultation, teaching, research, and various other types of involvement.
2. Direct Services
   To accomplish its mission, and while upholding the established state and APA (American Psychological Association) ethical principles and code of conduct for psychologists, the UCPS provides a variety of services to the Lehigh University community including:
   - Crisis Intervention Services (On call 24/7 at 610 758 3880 and select #0)
   - Group and Individual Psychotherapy
   - Peak Performance
   - Outreach Programming
   - Assessment and Evaluation
   - Consultation Services
   - Training
   - Advocacy

More information can be found at: http://studentaffairs.lehigh.edu/counseling (http://studentaffairs.lehigh.edu/counseling/)

Career and Professional Development

One function of a college education is to foster the growth and development of the student to prepare for a meaningful and satisfying life after college. Lehigh provides career planning services for undergraduate and graduate students as an integral part of the career development process.

Career planning can best be described as an educational process through which students

1. identify and develop their abilities, aptitudes, and interests;
2. learn the relationship between their capabilities and interests, their university experiences, and professional opportunities outside the university; and
3. prepare for those opportunities.

The office is open throughout the year. The main phone number is (610)-758-3710 and the website is www.lehigh.edu/careerservices (http://www.lehigh.edu/careerservices/).

OFFICE OF FELLOWSHIP ADVISING

The Office of Fellowship Advising (OFA) assists Lehigh students who are applying for competitive national fellowships and scholarships. It publicizes opportunities, oversees the selection of candidates for awards that require university nomination and, with the assistance of fellowship advisors, guides students through the frequently complicated application procedures.

The OFA web-site (https://ofa.lehigh.edu/) contains a searchable database of a wide variety of fellowships and scholarships for students research The database includes inks to the foundations' official sites, deadlines, and a general descriptions. Other resources and information on the application process are provided on the website as well.

Students who are interested in applying for awards and faculty members working with motivated, well-qualified students are encouraged to email the Office of Fellowship Advising at ofa@lehigh.edu.

CENTER FOR COMMUNITY ENGAGEMENT

The Lehigh University Center for Community Engagement (CCE) (http://cce.lehigh.edu/) assists Lehigh's faculty, staff, and students who are involved with service-learning classes or community-based research projects **globally** and **locally**, mobilizes university-community partnerships to address societal challenges, promotes knowledge and research for the common good, and helps cultivate

engaged citizens. We are a centralized resource for all community members to support high-quality research, learning, and active citizenship.

The Center for Community Engagement offers a variety of resources from one-on-one consulting to workshops and courses to faculty development and evaluation/assessment support. A number of courses, such as SOAN/HMS 120: Values and Ethics of Community-Engaged Research (http://catalog.lehigh.edu/courselisting/soan/), also offer formalized training in community-engaged research. Finally, the center can be a sounding board in the early stages of any project to ensure reciprocal, ethical, and meaningful experiences for our community and our institution. A yearly community-engaged learning and research symposium is held to highlight exceptional academic learning, community partnerships, and research collaborations.

The Center for Community Engagement is located in Williams Hall 020 and has space for meetings, informal discussion, and computer workstations for those working on community projects. Contact via email at inengage@lehigh.edu or via phone 610-758-1081. The website is accessible at: http://cce.lehigh.edu/.

Office of International Affairs

“Lehigh University prepares graduates to engage with the world and lead lives of meaning.”

—Lehigh University Vision Statement

The Office of International Affairs drives the university’s international strategy, helps students and faculty go abroad, supports international students and scholars, cultivates international partnerships. Our area includes Fellowship Advising, the Global Citizenship Program, Global Partnerships and Strategic Initiatives, the Global Union, Iacocca Institute, Iacocca International Internship Program, the International Center for Academic and Professional English, the Office of International Students and Scholars, Study Abroad, and the United Nations Partnership.

Fellowship Advising

Bill Hunter, Director, Fellowship Advising and UN Programs
32 Sayre Drive, Coxe Hall, Room 114, Bethlehem, PA 18015-3123
(610) 758-4505
wdh3@lehigh.edu

Elena Reiss, Assistant Director, Fellowship Advising and UN Programs
32 Sayre Drive, Coxe Hall, Room 113, Bethlehem, PA 18015-3123
(610) 758-4716
elr312@lehigh.edu (wes307@lehigh.edu)

Jennifer Marangos, STEM Student Advisor
32 Sayre Drive, Coxe Hall, Room 203, Bethlehem, PA 18015-3123
(610) 758-4977
jem8@lehigh.edu

Email: ofa@lehigh.edu (http://global.lehigh.edu/fulbright/)

https://global.lehigh.edu/fellowship-advising (https://global.lehigh.edu/fellowship-advising/)

The Office of Fellowship Advising assists Lehigh students and alumni who are applying for competitive national fellowships and scholarships. It publicizes opportunities, oversees the selection of candidates for awards that require university nomination and, with the assistance of fellowship advisors, guides students through the complex application procedures. Students who are interested in applying for awards, and faculty members working with motivated, well-qualified students, are encouraged to contact the office.

Global Union

Patricia Goldman, Assistant Director for International Student Engagement & Advisor of the Global Union

Office of International Students & Scholars
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global.lehigh.edu/globalunion (http://global.lehigh.edu/globalunion/)

The Global Union is a student-led collaboration of more than 30 student clubs and organizations that promote global awareness and cultural understanding within the Lehigh community. Students involved in the Global Union hail from all corners of the globe, and hold positions as Executive Board, Ambassador, or Member Club representative.

The Global Union sponsors and supports events from member clubs in addition to their own programming. They play a large role in International Education Week and supporting the many cultural clubs on Lehigh's campus, and put a strong focus on collaboration. All events sponsored by the Global Union are free and open to the Lehigh community.

For more information regarding the Global Union, see the website at global.lehigh.edu/globalunion (http://global.lehigh.edu/globalunion/).

Iacocca Institute

IACOCCA INSTITUTE®

111 Research Drive; 610-758-6723

Cheryl Matherly, Director, Vice President and Vice Provost, International Affairs and Interim Director, Iacocca Institute; Michael Schaefer, Associate Director; Carrie Duncan, Program Director; Mourica Sentine- George, Coordinator; Wagner Previato, Program Manager, Junior Reina Toc, Program Manager.

The Iacocca Institute creates transformative experiences that challenge, develop, and empower the next generation of global leaders. Its programs are immersive, highly diverse, cross-cultural, and experiential. The Institute collaborates with university and industry partners to bring the impact of these experiences to young leaders throughout the Lehigh community and across the globe. Over the years, the Institute has built partnerships on every continent and engaged 4000+ program participants, from students to mid-career professionals, from 150 countries.

Current Iacocca Institute programs include:

Iacocca Global Village for Future Leaders® (GV)
Now entering its 27th year, the Iacocca Global Village engages advanced university students (both undergraduate and graduate) and young professionals from around the globe in an immersive intercultural learning experience.

The Iacocca Global Village us available to a select number of Lehigh undergraduate/graduate students/young alumni and faculty/staff, as well as students and professionals from other universities and organizations worldwide. All Lehigh students, faculty, and staff receive a 50% program fee discount. In addition, the Institute awards 5-7 full Global Village program fee scholarships for Lehigh students and young alumni each year. A variety of scholarships and sponsorships are also available for international students and professionals through the Institute's global partner and alumni networks.

This program builds participants' leadership and entrepreneurship skills and demonstrates both the positive impact of culture and diversity in an organizational setting as well as the power of international networks. Iacocca Global Village combines a five-week residential intensive with a longer period of virtual community, programming and mentorship. During the five-week summer residency, Villagers live and work together, engage in consulting projects for international organizations, and participate inn leadership development and culture-sharing activities. The program strives to maximize diversity- 60 to 90 participants from 30-40+ Countries, including the U.S.-to facilitate intercultural learning. The highly active Global Village network has more than 2450 alumni from more than 140 Countries. Many GV alumni continue to serve the program as mentors, experts, and clients throughout their careers.

Iacocca Global Entrepreneurship Intensive (formerly the Pennsylvania School for Global Entrepreneurship)
Now in its 23rd year, the Iacocca Global Entrepreneurship Intensive (IGEI) brings top U.S. and international high school students together for a four-week intensive global leadership and entrepreneurship learning experience. This summer program challenges students

to develop greater cultural awareness and leadership skills while practicing their design thinking with other students, faculty, and entrepreneurs. IGEI 2023 is a four-week on campus program that combines real-world learning opportunities and global experiences. Participants will work as part of an intercultural team, solving real problems for U.S. and international client companies. They'll also meet other bright high school students from around the world, forming friendships that will last a lifetime. To date, IGEI participants include over 1600 students from 67 countries and 23 states. The Institute also plans to run additional virtual programs for global accessibility and options.

Iacocca Global Village on the Move (GVOTM)
Created in collaboration with the Institute's network of global university and organizational partners, Global Village on the Move (GVOTM) programs are customized 7-10 day programs that provide immersive leadership and cultural experiences, tailored to regional themes, for local and global professionals, including Institute and Lehigh alumni. The Institute has worked with partners in Peru, Spain, Australia, the United Arab Emirates, Malaysia, Italy, China, Russia, and India to deliver GVOTM programs in 12 cities on four continents over the past 23 years. This year we will be hosting a two-part GVOTM. The first part will take place virtually over seven weeks: 90 participants from over 25 countries will work in teams on real-world consulting projects as well as participate in an interactive virtual curriculum to learn about leadership and business. Participants will then attend an in country (location TBD) one-week intensive, where they will work as a cohort to solve an SDG related challenge and learn about local people and customs.

Additional custom programs and partnership opportunities
The Institute regularly develops customized experiences and hosts other intensive leadership programs that align with its mission. In summer 2023, the Institute will host 25 Fellows from sub-Saharan Africa for a fifth Mandela Washington Fellowship Leadership in Business Institute, a program of the U.S. Department of State. In addition, the Institute will host a group of 50 high-school students virtually from Osaka, Japan for a one-week business, entrepreneurship, & SDG intensive experience.

The Iacocca Institute was established in 1988 in partnership with Lehigh alumnus and automotive icon Lee A. Iacocca '45, former chairman and chief executive officer, Chrysler Corporation.

For more information, contact Michael Schaefer, Associate Director (mrs406@lehigh.edu), Director, Iacocca Institute, Iacocca Hall, Lehigh University, 111 Research Drive, Bethlehem, PA 18015.

International Center for Academic and Professional English

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https://global.lehigh.edu/icape (https://global.lehigh.edu/icape/)

The International Center for Academic and Professional English (ICAPE) at Lehigh University offers a variety of year-round courses (https://global.lehigh.edu/icape/credit-courses/), language/culture workshops (https://global.lehigh.edu/icape/workshops/), language testing (https://global.lehigh.edu/icape/testing-services/), and private tutoring (https://global.lehigh.edu/icape/tutoring/) for undergraduate and graduate students who would like to improve their academic English skills and their understanding of American pragmatics and culture.

UNDERGRADUATE ENGLISH DEPARTMENT COURSES FOR CREDIT

Based on language test scores and an English placement test, undergraduate students who are multilingual speakers of English (and those who speak varieties of English other than standard American English) may be required or may choose to register for WRT 003 and WRT 005 (Composition and Literature for International Writers I and II, formerly ENGL 003 and 005) as their required first-year English composition courses. These two courses, taken consecutively in the Fall and Spring semesters, are designed specifically with multilingual writers of English in mind, and they can substitute for WRT 001 and WRT 002 general composition course (formerly ENGL 001 and 002).

*Successful completion of WRT 003 fulfills the same first-year requirement as WRT 001. NOTE: If a student is awarded credit for WRT 001 by RAS, that student will not receive additional credit for taking WRT 003.

*Successful completion of WRT 005 fulfills the same first-year requirement as WRT 002. NOTE: If a student is awarded credit for WRT 002 by RAS, that student will not receive additional credit for taking WRT 005 or WRT 011.

WRT 016 (Recitation Session for Critical Reading and Composition) and WRT 017 (Recitation for Research and Argument) are additional 1-credit support seminars that will help students succeed in WRT 001, 002, 003, and 005.

Multilingual English-speaking students who need additional focused practice to help them improve their academic English language skills may be required to register for ENGL 015 (Speech Communication for International Speakers) and/or ESLP 003 (Intelligibility and Comprehensibility in English).

GRADUATE ACADEMIC & PROFESSIONAL COMMUNICATION (ESLP) COURSES FOR CREDIT

Based on language test scores and graduate department requirements, graduate students who are multilingual speakers of English (and those who speak varieties of English other than standard American English) may be required or may choose to register for courses in academic writing, speaking & listening, and advanced academic presentations offered in both Fall and Spring semesters. These courses include ESLP 001 (Academic Writing and Grammar), ESLP 002 (Academic Writing and Reading for Research), ESLP 003 (Intelligibility and Comprehensibility in English), ESLP 004 (Advanced Academic Speaking), and/or ESLP 011 (Technical Writing and Composition).

INTERNATIONAL TEACHING ASSISTANTS FOR CREDIT/NON-CREDIT

For **multilingual English-speaking Teaching Assistants**, ESLP 012 (Advanced Presentation Skills for Teaching Assistants) and/or ESLP 003 (Intelligibility and Comprehensibility in English) and/or tutoring may also be required, depending on required language testing. For language testing of teaching assistants, please see the following web site: https://global.lehigh.edu/icape/testing-services (https://global.lehigh.edu/icape/testing-services/)

STEPUP INTENSIVE ENGLISH PROGRAM FOR NON-CREDIT

The StepUp Program is a rigorous, non-credit English program for admitted as well as non-admitted Lehigh students who choose to, or are required to, improve their English skills while taking or prior to taking credit courses at Lehigh University. The StepUp program enhances students' English skills in advanced academic reading and writing, spoken academic language, and American pragmatics through intensive practice, integrated skills focus, and experiential learning on campus. StepUp also serves as an excellent orientation to the Lehigh University culture and the expectations of a university classroom. StepUp courses may fulfill requirements for conditionally admitted students.

For program information, dates, fees, and registration forms, visit the StepUp website: https://global.lehigh.edu/icape/stepup (https://global.lehigh.edu/icape/stepup/)

ENGLISH LANGUAGE AND LEARNING ASSESSMENT LAB (ELLA)

In addition to English language testing for graduate and undergraduate students in the English Language and Learning Assessment Clinic (ELLA), ICAPE offers one-on-one and small-group tutoring. Specifically, tutoring students study individually with a professional ICAPE language specialist utilizing a curriculum customized to each student's interests and needs. Tutoring for graduate students is fee-based. Undergraduate students can have a maximum of three tutoring sessions for free. For tutoring dates,

fees, and registration forms, visit the ICAPE Tutoring website: https://global.lehigh.edu/icape/tutoring (https://global.lehigh.edu/icape/tutoring/).

FREE ICAPE WORKSHOPS

Throughout the academic year (fall, spring, and summer), ICAPE offers free workshops that focus on helping students improve their language and communication skills for academic, professional, and personal communication in real cultural situations. Practice in grammar, vocabulary, and pronunciation as well as conversation strategies and academic language skills in English are the focus. Some workshops are in-person, some are virtual, and some are hybrid, and they are held at various times to accommodate different participant's schedules and time zones. We also have an archive of popular, previously recorded workshops on our website. See our current slate of workshops: https://global.lehigh.edu/icape/workshops (https://global.lehigh.edu/icape/workshops/)

International Internships

Carol S. Strange, Director
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global.lehigh.edu/internships (http://global.lehigh.edu/internships/)

IACOCCA INTERNATIONAL INTERNSHIP PROGRAM

There are many opportunities for Lehigh University students to gain hands-on experience in an international setting. For a complete listing, please refer to the Study Abroad website (http://www.lehigh.edu/%7Eincis/). Lehigh University's Iacocca International Internship Program, as referenced here, specifically relates to a program that provides students with fully-funded fellowships to participate in internship, research, or practicum experiences in organizations around the world. The program provides full-time, non-credit bearing experiences that run for six to twelve weeks over the summer, allowing for a true cultural immersion. For more information, please visit global.lehigh.edu/internships (http://lehigh.edu/intint/oiaii/)

International Students and Scholars Office

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Website: http://global.lehigh.edu/oiss (http://www.lehigh.edu/~intnl/)
iHome (online system for international students and scholars): https://iss.lehigh.edu

The Office of International Students and Scholars (OISS) is a university-wide resource for students and scholars from abroad and the Colleges and departments who host them. The mission of OISS is to empower Lehigh's international community through holistic support and advising in order to create global-minded citizens. OISS accomplishes this mission in a number of ways:

- OISS educates international students and scholars on how to maintain their immigration status, we advise faculty, staff and departments on what is required to host international students/scholars, and we ensure that the University is in compliance with immigration regulations.
- OISS strives to be well-connected to other offices and departments on campus in order to support the entire experience of our international students and scholars.
- OISS provides international programming designed to bolster the professional and personal development of our international community. We also provide an avenue for our represented countries and cultures to share and engage with the greater campus community.
- OISS continually advocates on behalf of our students and scholars regarding immigration, academic, and personal matters to ensure that their voices are heard within the Lehigh community and beyond.
- OISS aims to facilitate ways for our international students and scholars to engage beyond the Lehigh campus.

Services

While core of the work that OISS does is related to immigration compliance, we also offer a variety of cross-cultural programs, including undergraduate and graduate orientations for incoming international students, seminars/workshops on immigration benefits and pathways, International Education Week in November, the annual International Bazaar in April. OISS also offers regular social programming and off-campus excursions.

The academic year for incoming international students at Lehigh begins with the International Student Orientation. Orientation details are available on the OISS website, and this orientation is mandatory for all incoming International students. OISS partners with offices around campus to address topics specific to the international student experience, and takes place immediately before university-wide orientations (department/College-specific for Graduate students, through the Office of First Year Experience for Undergraduates). At International Student Orientation, students will learn how to maintaining immigration status, apply for a social security number, open a banking account, gain understanding of the U.S. health care system, and connect with peers about adjusting to university life at Lehigh and in the United States.

ADDITIONAL SPECIAL SERVICES FOR INTERNATIONAL STUDENTS

Center for Career And Professional Development

Advising and special workshops for careers for international students are provided.

Dining Services

For undergraduate students on the meal plan, menus meet the international dietary needs of the students. Students with dietary restrictions or concerns can meet with the Lehigh Dietitian.

Health AND WELLNESS Center

Fully staffed medical personnel meet both the physical and personal needs of all students.

COUNSELING & PSYCHOLOGICAL SERVICES

The Counseling Center has special services for international students.

Immigration/Visa Advising

Advising about immigration compliance is provided by OISS.

CENTER FOR ACADEMIC SUCCESS

Free tutors are provided in writing, math and science.

INTERNational AND CULTURAL Clubs

Clubs from all regions of the world are established on campus. They form an important part of the cross-cultural dimension of the campus, providing social events, films, and international dialogue.

Religious Services

Services for all the major religions are on campus or nearby, including Muslim, Christian, Jewish, Hindu and Buddhist. The Chaplain's Office can provide additional information.

Lehigh University/United Nations Partnership

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Email: inun@lehigh.edu (LehighUNPartnership@lehigh.edu)

Lehigh University is the sixth university in the world to be certified as a Non-Governmental Organization affiliated with the United Nations (UN) Department of Public Information. Through this partnership, Lehigh students, staff, and faculty attend private briefings with ambassadors and UN officials, take tours of UN headquarters, and

attend conferences, workshops and symposia at the UN in New York City. Lehigh also hosts a UN Speaker Series on campus and places interns each semester at the UN.

For more information about the Lehigh University/United Nations Partnership, see the website at: https://global.lehigh.edu/un-partnership (https://global.lehigh.edu/un-partnership/)

Study Abroad Office

Katie Welsh Radande, Director; Katy Rene, Assistant Director; Antonio Ellison, Assistant Director; Jodeen Joyner, Advisor; Brian Wasserman, Advisor; Denise Leonard, Coordinator

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global.lehigh.edu/studyabroad (http://global.lehigh.edu/studyabroad/)

Lehigh University recommends international study. We support programs that offer rigorous academic environments, immersion in host cultures, and opportunities for personal growth. Students should return to Lehigh with an enhanced ability to appreciate global concerns.

Every student who studies abroad has different reasons and goals. High priorities for many students include developing sophisticated perspectives on global economic, social, and political issues, seeing the theoretical come to life in a real-world context, learning a new language, engaging with people and cultures different from their own, developing valuable career skills, and earning academic credit toward a Lehigh degree. Many students find that study abroad is a catalyst for intellectual and personal growth.

The Study Abroad Office conducts extensive advising activities, guiding students through the process of identifying programs that fit personal and academic goals; group and individual advising sessions take place regularly. Study Abroad options exist for all majors and can take place Freshman through Senior year. Students should start discussing study abroad options with their academic advisor and the Study Abroad Office as early as Freshman year.

SEMESTER/YEAR

Lehigh approves over 250 semester and year-long programs of academic study in over 60 countries. The programs are evaluated by faculty in order to ensure high academic quality and immersion in host cultures. Academic credit is given for programs approved by Lehigh faculty only. Students must receive a 'C' or better for credit to transfer. Grades earned on semester and year programs are not factored into the student's GPA. Semester study abroad may include a combination of traditional coursework along with credit-bearing internships, research, or service learning.

SUMMER AND WINTER TERM STUDY ABROAD

Lehigh offers several faculty-led summer and winter term study abroad courses. Past programs have included: Business and Music in Belgium; Business in Prague; Microfinance Abroad in various locations; Art and Architecture in Vicenza; History in Paris; Internships and Language in Shanghai; Sustainable Development in Costa Rica; Architecture in Munich; Research Practicum in Ireland. Several options include internship opportunities for credit in addition to coursework. Lehigh credit and grades are applied to a student's transcript and are factored into the student's GPA.

ADDITIONAL INTERNATIONAL EXPERIENCES

Lehigh offers additional short-term international experiences such as International Internships, ServeAbroad Antigua, Choir, Engineers without Borders (EWB), Philharmonic, Interfaith Dialogue: Lehigh in Rome, and others.

To view all program options and begin planning for a Study Abroad Experience, visit global.lehigh.edu/studyabroad (http://global.lehigh.edu/studyabroad/).

Special Academic Programs

LIFELONG LEHIGH

Lehigh University is a place where you can intellectually develop, as a student or as an alumnus. We provide many opportunities for advancing your credentials and knowledge, such as accelerated Bachelor's to Master's programs in many academic units, online master's programs for students who are working full-time, and a wide variety of alumni opportunities to engage, such as through Mountain Talks (https://alumni.lehigh.edu/mountain-talks/).

ONLINE EDUCATION

As a proven leader in distance education and innovation, Lehigh University's Office of Distance Education (https://distance.lehigh.edu/online-programs/) has been committed to providing graduate programs and certificates to working professionals for over 25 years. Our programs emphasize academic excellence with a distinguished faculty, a shared community of learners, and superior curriculum. We are accredited by the Middle States Commission on Higher Education. Our distance programs provide students with the same level of educational excellence for which Lehigh University is renowned and strives to maintain the same level of quality of instruction and student service that is available to our on-campus students.

Through a unique approach to learning, we utilize two learning platforms for our programs: **Classroom LIVE**, an integrated, web-based virtual environment that delivers graduate programs in real time from classrooms on Lehigh's campus to students, in their homes, at their workplaces, or while traveling, and **Classroom Online**, an asynchronous online format that offers flexible scheduling and participation. To provide the best educational experience for our students, supplemental tools may be used, including podcasts, real-time web-based conferencing, shared applications, and use of Course Site, Lehigh's course management system.

Through Distance Education (https://distance.lehigh.edu/online-programs/), we offer seven graduate degrees in a variety of disciplines which include Biological Chemical Engineering, Chemical Engineering, Healthcare Systems Engineering, Flex MBA, Mechanical Engineering, Molecular Biology, and Polymer Science & Engineering. We also offer three graduate certificates for credit. They include Chemical and Biomolecular Engineering, Healthcare Systems Engineering, and Polymer Science & Engineering. .

In addition to those programs offered formally through Distance Education, the programs in Data Science (https://engineering.lehigh.edu/datascience/academics/masters-science/), as well as Bioengineering (https://engineering.lehigh.edu/bioe/graduate/ms-bioengineering/) can be completed fully online. We also offer several programs in the College of Education (https://programs.ed.lehigh.edu/), including a Master's of Education in Educational Leadership, a Master's of Education in Mental Health Counseling, and a Master's of Education in Behavioral Analysis.

CONTINUING AND EXECUTIVE EDUCATION

Lehigh University academic departments and research centers offer a varied selection of non-credit continuing education programs for adults, as well as Executive Education through the Vistex Institute (https://business.lehigh.edu/executive-education/). Reflecting Lehigh's traditional educational strengths, these offerings focus on professional development, organizational problem solving, and technical skills. They carry no regular academic credit, but participants can often earn some form of continuing education credentials.

Lehigh continuing education programs are designed to meet specific needs. Contents, schedules, and timing are adapted to effectively serve the audiences for which they have been developed. Apart from programs presented on the Lehigh campus, a number of seminars are available for "in-house" presentation to organizations on a contract basis. For more information about these programs, contact the appropriate department or research center.

Undergraduate Studies

A listing of undergraduate and graduate courses offered by Lehigh University can be found in the Courses, Programs, and Curricula section (p. 60), under each departmental heading. For purposes of record, all approved courses are listed. It must be understood, however, that the offerings in any given semester are contingent upon a number of factors, including student needs as determined at the time of registration.

CREDIT HOURS

Each course is designated a credit value of the course in terms of semester hours ("credit hours").

COURSE NUMBERING

The course numbering system specifies which courses can be applied to the program of study as the student progresses toward the undergraduate or graduate degree. In general, the numbering series is as follows:

- **0-99**. Courses primarily for freshmen or sophomores. Not available for graduate credit.
- **100-199**. Intermediate-level undergraduate courses. Not open to freshmen except by petition. Not available for graduate credit.
- **200-299**. Advanced undergraduate courses. Courses in the College of Business and specific departments as noted in the listings are open to freshmen and sophomores only with permission. Not available for graduate credit in the major field.
- **300-399**. Advanced undergraduate courses. Same as 200-299, but available for graduate credit in major field.
- **400-499**. Graduate-level courses, open to undergraduates only by petition.

PROVISIONAL COURSES

Each instructional department is authorized to offer provisional courses, or those offered on a trial basis, as well as special opportunities courses. Such courses can become a permanent part of the university curriculum. These courses are numbered, as is appropriate, 95-98 . . . 195-198, . . . 295-298, . . . 395-398, and may only be offered twice, which must be done within a two-year timespan.

PREREQUISITES

Academic preparation required for admission to courses is indicated under "prerequisites" included at the end of each course description. Prerequisites are stated in most cases for purposes of convenience in terms of Lehigh courses. Academic status required for admission, where numbering does not fully describe this status, is also indicated under "prerequisites."

A student who does not have the status (e.g., sophomore standing) or the academic preparation set forth as prerequisites may request special consideration. A student may obtain online permission from the designated college or department officer or demonstrate academic work completed elsewhere meets the prerequisites listed. Each student is responsible to make sure they meet and maintain all conditions of prerequisite for their coursework prior to the start of classes. If a student fails to meet a prerequisite after registration for a given course, the college dean's office, the Office of the Registrar, and/or the instructor may take action to drop the student from a course with unmet prerequisites.

In a few cases, co-requisites are indicated. In such instances the co-requisite course is taken in the same semester.

INFORMATION LIMITS

The course descriptions are intended to guide the student in selecting appropriate courses. For reasons of space, descriptions are brief. In most cases, courses will have a significantly broader scope than the topics listed in the description. In some courses, material may change from what is described. If there is doubt concerning the appropriateness of any course for the individual's educational objectives, it is suggested that the student confer with the adviser.

ABBREVIATIONS

Whenever possible, course listings contain information indicating what requirements the course satisfies, the semester or semesters in which it is offered, and the name of the scheduled instructor or instructors.

While all information herein is subject to change, the information is included to serve as a guide in the selection of appropriate courses that best fulfill the student's academic requirements and personal goals.

The symbols following course descriptions for some **College of Arts and Sciences** courses include:

AL. Courses that meet the Arts & Languages distribution requirements.
CC. Courses that meet the Contemporary Challenges distribution requirements.
GC. Courses that meet the Global Citizenship program requirements.
HE Courses that meet the Human Experience distribution requirements.
HU. Courses that meet the Humanities distribution requirements.
LS. Courses that meet the Lab Science distribution requirements.
MA. Courses that meet the Mathematical distribution requirements.
ND. Not designated to meet distribution requirements.
NS. Courses that meet the Natural Science distribution requirements.
NW. Courses that meet the Natural World distribution requirements.
Q. Courses that meet the Quantitative Reasoning distribution requirements.
SS. Courses that meet the Social Science distribution requirements.
SW. Courses that meet the Social World distribution requirements.
W. Courses that meet the Writing distribution requirements.
WRIT. Courses that meet the Writing Intensive distribution requirements.

The symbols following course descriptions for some **College of Business** courses include:

BUD. Courses that meet the Business Diversity distribution requirements.
BUG. Courses that meet the Business Global distribution requirements.

The symbols following course descriptions for some **College of Health** courses include:

DEIN. Courses that meet the Diversity, Equity & Inclusion distribution requirements.
HEBI. Courses that meet the Health Bioethics distribution requirements.
HESC. Courses that meet the Health Science Writing distribution requirements.
SUST. Courses that meet the Sustainability distribution requirements.

The symbols following course descriptions for some **College of Engineering and Applied Science** courses include:

ES. This code plus the following number indicates that the course satisfies a number of hours of engineering science requirements for ABET accreditation.

Graduation Requirements

Students are expected to maintain regular progress toward the baccalaureate degree by carrying the "normal" course load—between 12 and 18 credit hours each semester. Each student is expected to complete the baccalaureate degree by attending four consecutive years and eight semesters. They may, however, wish to accelerate the pace toward graduation by using advanced placement credits, summer session study, and receiving credit for courses through examination. Students will have a limit of 8 calendar years to complete the requirements for the bachelor's degree. Students may petition the Committee on Standing of Students (SOS) for up to a one-year leave of absence for special circumstances beyond their control.

Students in good academic standing earn their degrees by meeting the requirements of their specific degree curriculum as well as general university requirements. Students are expected to satisfy the credit-

hour requirements of their chosen curricula. Students should confer with their advisors on matters related to curriculum.

Basic military science credit hours are in addition to the credit hours specified in the curricula. A maximum of six credit hours of advanced military science courses may be applied toward the baccalaureate degree.

Upon graduation a student's record is considered closed and no further changes to grades, majors, minors and certificates are possible.

Undergraduate Residency Requirement

To be eligible to receive a Lehigh baccalaureate degree, the candidate must have completed either a minimum of 90 credit hours at Lehigh, or must have completed 60 of the last 75 credit hours required for the degree at the University or in residency programs.

Five-Year, Two-Bachelor-Degree Programs

The university's five-year, two-degree programs enable a student to receive two bachelor degrees upon completion of five years of study.

The civil engineering and earth and environmental sciences program that affords two bachelor degrees, and the electrical engineering and engineering physics two-degree program are examples of programs in the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science.

Some five-year, two-degree programs appear in the description of courses under Arts-Engineering and Five-Year Programs. It is possible to arrange for a dual bachelor degree program even after studying at Lehigh for some time. Engineering students, for example, who decide at any stage of study that they wish to meet the requirements for both the bachelor of arts and bachelor of science degree may sometimes complete the combined requirements in five years if the decision is made before the third year.

A student entering Lehigh to obtain a second bachelor's degree, those Lehigh students who wish to declare a second degree in another college, or students wishing to pursue both a B.A. and a B.S. degree within the College of Arts and Sciences must have a minimum of 30 additional credit hours beyond the first degree credit-hour requirements in order to qualify for the second degree. All of the 30 additional credit hours must be taken at Lehigh or in Lehigh residency programs. All special second degree programs must be approved by the dean of the college in which the degree is to be offered and the Standing of Students Committee.

Several ways exist for students to obtain two degrees in five years of study. See listings under ARTS-Engineering; Civil Engineering and Earth and Environmental Sciences; Electrical Engineering and Engineering Physics; and College of Education.

Advisement

The academic advisor is one of the most valuable resources in the educational process, not only to assist in making academic selections to match the student's particular background, interests, and future objectives, but also to identify program options, to work out an academic pace, and to develop career planning strategies. The advisor will help to identify other resources and support systems available at the university, such as the Center for Academic Success, Counseling and Psychological Services, and the Center for Career and Professional Development.

Every undergraduate in the College of Arts and Sciences is assigned a faculty advisor upon matriculation. This advisor will usually change when the student selects a major or program.

First year students in the P.C. Rossin College of Engineering and Applied Science are advised by the Rossin College advising staff until they declare a program near the end of the first year. At that point they are assigned a faculty advisor from their program of study.

Every undergraduate in the College of Business is assigned to a professional advisor in the College of Business Undergraduate Programs Office. Once a major is declared, a faculty mentor from the major department will be assigned for more in-depth conversations about major courses and career paths.

Undergraduate students who enter into the College of Health are assigned a faculty advisor who will follow them throughout their academic career. Concurrently, professional staff advisors provide support and serve as a resource to students. College of Health faculty and staff advisors guide students on course selections, experiential learning opportunities, post graduate education and career paths.

Students who are in the Integrated Business and Engineering program (IBE), the Integrated Degree in Engineering, Arts and Sciences (IDEAS), and the Computer Science and Business (CSB) program are advised by program-specific academic advisors and the faculty co-directors of these programs in the first year of study. Additional advisors are identified in disciplinary areas as the student advances through the program.

Pre-professional advisors, such as Pre-law, Pre-medicine and Pre-MBA are located in the Center for Career and Professional Development.

Guide to Academic Rules and Regulations

Over the years, the University has adopted numerous rules and regulations. Some of the principal rules and regulations are given here so that currently enrolled and potential undergraduates and graduate students will be apprised of what is expected of them, and what they can expect of the University.

This section concerns academic regulations. Additional regulations can be found in the Lehigh Student Handbook (http://studentaffairs.lehigh.edu/handbook/), and there is a comprehensive statement of all policies in the publication Rules and Procedures of the Faculty. The Rules and Procedures of the Faculty can be found online on the Provost's website.

Eligibility for Degree

Candidates for a baccalaureate degree must achieve a minimum cumulative average of 2.00.

To be eligible for a degree, a student must not only have completed all of the scholastic requirements for the degree, but also must have paid all university fees, and in addition all bills for the rental of rooms in the residence halls or in other university housing facilities. Payment also must have been made for damage to university property or equipment, or for any other indebtedness for scholarship loans or for loans from trust funds administered by the university.

Responsibility for meeting academic requirements.

Each student is solely responsible for his or her progress toward meeting specific requirements for graduation. Academic advisers, department chairs and the associate deans staff are available to assist the student. It is strongly recommended that the student specifically consult with his or her adviser prior to the senior year to ascertain eligibility for the degree for which he or she desires to qualify and to determine that all program and hour requirements are met.

A student degree audit (http://go.lehigh.edu/degreeaudit/) is available 24/7 via the online student information system for all undergraduate students. Students should review their audit before registering for each semester, including each in their senior year. The degree audit is provided as a tool to aid in advising and to track academic progress and degree completion. The student degree audit attempts to note all program deficiencies based on real-time academic history and current registration information. However, each student is responsible for the completion of all graduation requirements as outlined in the University catalog.

Final date for completion of requirements.

For graduation, all requirements, scholastic and financial, must be satisfied no later than noon, the Friday preceding the degree award date.

Application for Degree

Candidates for graduation on University Day in May must apply on or before February 1; candidates for graduation in August must apply on or before July 1; candidates for graduation in January must apply on or before October 1. Students must apply online using the Banner Student Information System.

Applications submitted after the specified deadline will be charged a late application fee. No applications will be accepted within three weeks of the graduation date. Students who fail to submit an application must apply for the next available degree awarding date.

Undergraduate Credit and Classification

A “semester hour,” used interchangeably with “credit hour,” is a course unit normally involving three to four hours of student effort per week during one semester. This includes both in-class contact hours and out-of-class activities. The major parameters influencing the in-class/out-of-class division include the mode of instruction and the level of the course.

Student Classification Guidelines

Student classification is based on completed credit hours. Currently enrolled courses (in progress courses) are not used for this calculation. The following outlines total earned credits required for each classification:

EARNED CREDITS	CLASSIFICATION
0-23	Freshman
24-53	Sophomore
54-83	Junior
84+	Senior

Definitions of Grades

Course grades are A, A–, B+, B, B–, C+, C, C–, D+, D, D–, P, F, N, SP, X, Z. The meaning of each grade is as follows: A, A–, excellent; B+, B, and B–, good; C+ and C, competent; C–, continuation competency (the student has achieved the level of proficiency needed for the course to satisfy prerequisite requirements); D+, D, and D–, passing, but performance is not adequate to take any subsequent course which has this course as a prerequisite. P, pass-fail grading with a grade equivalent to D– or higher; F, failing; N or SP, incomplete; X, absent from the final examination; Z, absent from the final examination and incomplete.

Grades are weighted as follows: A, 4.0; A-, 3.7; B+, 3.3; B, 3.0; B-, 2.7; C+, 2.3; C, 2.0; C-, 1.7; D+, 1.3; D, 1.0; D-, 0.7; F, 0. Quality points for each course are assigned according to the number of credit hours in the course.

Other symbols used for courses on student records are: W, withdrawn; CR, grade of C- or higher, credit allowed; DCR, does not meet prerequisites, credit allowed; NCR – no credit. NR is used when no final grade was received from the instructor of record by the final grade submission deadline.

Grades in the range of A through D–, P, and CR may be credited toward baccalaureate degrees within the limits of program requirements. Grades of F, N, SP, X, Z, W, and NR cannot be credited toward the degree. Grades of W do not count as hours attempted.

Courses in which grades of D+,D, D-,F, NCR, W, NR, N, SP, X, or Z are recorded do not meet prerequisite requirements. The student may request to waive a prerequisite. Upon presentation of evidence of substantially equivalent preparation, and with the approval of the instructor of the course, the teaching department chairperson and the chairperson of the student's major department or program if applicable, the prerequisite may be waived.

The grade N (grade), may be used to indicate that one or more course requirements (e.g., course report) have not been completed. It is the obligation of the student to explain, to the satisfaction of the instructor, that there are extenuating circumstances (e.g., illness or emergency) that justify the use of the N grade. If the instructor feels the N grade is justified, he or she assigns a grade of N supplemented by a parenthetical letter grade, (e.g., NF). In such cases, the instructor calculates the parenthetical grade by assigning an F (or zero score) for any incomplete work unless he or she has informed the class in writing at the beginning of the course of a substitute method for determining the default grade.

In each case in which an N grade is given, the course instructor will provide written notification to the department chairperson stating the name of the student receiving the grade, the reason for the incomplete work, the work to be done for the removal of the N grade and the grade for the work already completed.

A student who incurs an N grade in any course is required to complete the work for the course by the fifth day of instruction in the next regular semester. The N grade will be converted into the parenthetical grade after the tenth day of instruction in the next regular semester, following receipt of the N grade, unless a petition to request an extension has been approved, or the instructor has previously changed the grade using the removal-of-incomplete procedure. The parenthetical grade will be dropped from the transcript after the assignment of the course grade.

The SP (grade) may be assigned for coursework or projects that do not conform to standard terms (e.g., thesis, research courses, open learning or multi-term project based learning coursework, etc.) when the student is making satisfactory progress; otherwise, the student should be assigned F. An SP grade will not be converted automatically but rather will remain until changed by the instructor or department chair when instructor is not available. SP grades count towards credits completed but do not affect GPA until converted.

The grade X (grade) is used to indicate absence from the final examination when all other course requirements have been met. In such cases, the instructor calculates the parenthetical grade by assigning an F (or zero score) for the missing final exam. The X grade may be removed by a make-up examination if the absence was for good cause (e.g., illness or other emergency). To be eligible for a make-up exam the student must submit a petition to the Dean of Students. If the student fails to petition, or if the petition is not granted, or if the student fails to appear for the scheduled make-up examination, then the X grade will be converted into the parenthetical grade after the first scheduled make-up examination following the receipt of the X grade. If the petition is granted and the final examination is taken, the X grade will be changed by the instructor using the make-up examination procedures and the parenthetical grade will be dropped from the transcript.

Where valid reasons exist for not taking the make-up examination at the scheduled time, the student may petition for a later examination with a fee.

The grade Z (grade) is used to indicate both absence from the final examination and incomplete course requirements. The instructor calculates the parenthetical grade using an F (or zero score) for the final examination and either an F (or zero score) for incomplete coursework.

A student who incurs a Z grade in any course is required to complete the work for the course by the fifth day of instruction in the next regular semester. The Z grade will be converted into the parenthetical grade after the tenth day of instruction in the next regular semester following receipt of the Z grade. In no case shall the deadline for completion of the work be later than the last day of classes in the first full semester in residence (except summer) following receipt of the Z grade.

N, X and Z grades do not count as hours attempted and are not used in computations of cumulative averages.

Where failure to complete coursework prevents the student from taking the make-up examination at the scheduled time, the student may petition the Committee on the Standing of Students for a later examination.

If no grade is received by the Office of the Registrar before student grades are officially posted, a grade of NR will be assigned. It is the responsibility of the faculty member who failed to submit a grade to resolve the situation. If a correct grade is not submitted or the situation is not otherwise resolved then the NR grade will be converted to a

grade of F on the tenth day of instruction of the next academic year semester.

Scholastic Averages and Probation

The Committee on Standing of Students uses the following guidelines to evaluate whether students are in Good Standing, on Scholastic Warning, on Scholastic Probation, or Dropped for Poor Scholarship.

1) A student is in Good Standing if their cumulative GPA is greater than or equal to 2.0 and they are making at least minimal progress towards their degree.

2) Undergraduate students with fewer than 19 completed credit hours can be in Good Standing, on Scholastic Warning, on Scholastic Probation, or Dropped for Poor Scholarship. Undergraduate students with 19 or more completed credit hours can be in Good Standing, on Scholastic Probation, or Dropped for Poor Scholarship.

3) Implications of Scholastic Warning, Scholastic Probation or Dropped for Poor Scholarship:

a) Students on Scholastic Warning will meet with their advisors and the Undergraduate Associate Dean of their College to develop a detailed plan of study, consultation with course instructors, etc., intended to achieve a rapid return to Good Standing. If the student fails to develop such a plan with their Undergraduate Associate Dean within the first two weeks of the semester, they will be put on Scholastic Probation.

b) Students on Scholastic Probation are ineligible for:

(a) intercollegiate competition and other extracurricular activities in which they publicly represent the university,

(b) major office (elected or appointed) in any university organization, and

(c) other activities which require more time than should be diverted from primary purposes by students whose academic survival is at risk.

The Dean of Students shall monitor and enforce this ruling. (See Lehigh University Student Code of Conduct on band regulations.) Scholastic probation will be effective at the end of each term.

c) Students Dropped for Poor Scholarship may be granted reinstatement by the Committee on Standing of Students. The student will be required to present a plan of study endorsed by their Undergraduate Associate Dean and approved by the Committee on Standing of Students. If a student is granted reinstatement, they will be on Scholastic Probation until they achieve Good Standing.

4) If a student fails to meet the standards for minimal degree progress, the Committee on Standing of Students may place the student on Scholastic Probation or Drop for Poor Scholarship. Note that courses with grades of W, F, or that were repeated during a later semester, do not count as completed credit hours. The standards for minimal degree progress are:

a) Complete at least 24 credit hours prior to the second year of enrollment.

b) Complete at least 48 credit hours prior to the third year of enrollment.

c) Complete at least 72 credit hours prior to the fourth year of enrollment.

5) The cumulative grade point average (GPA) is the weighted point average of all grades received in residence or at institutions specifically approved for grade transfer. The cumulative average is computed at the end of each term. The term GPA is a student’s GPA in the most recent term.

6) For students with fewer than 19 completed credit hours while in residence at Lehigh, academic standing will be determined as follows:

Term GPA greater than or equal to 2.0: Good Standing

Term GPA greater than or equal to 1.7 and less than 2.0: Scholastic Warning

Term GPA less than 1.7: Scholastic Probation or Dropped for Poor Scholarship

7) The Committee on Standing of Students will determine a student’s academic status if the student's cumulative GPA fails to meet the requirements for good scholastic standing as a result of a conversion of an N, X, or Z grade on the tenth day of instruction.

8) Students who, while on scholastic probation, attend either or both summer sessions or winter term will have their status reviewed at the end of the term by the Committee on Standing of Students.

Special Cases

a) Certain categories of students (e.g., those on financial aid, or those participating in intercollegiate athletics) will be expected to maintain whatever credit hours are required for eligibility.

b) Non-degree students with fewer than 12 credit hours attempted will not have their progress evaluated until they earn at least 7 credit hours. A non-degree student with two or more F grades is eligible to be reviewed by and may be placed on Scholastic Warning, Scholastic Probation, or Dropped for Poor Scholarship at the discretion of the Committee on Standing of Students.

c) Students who, regardless of their cumulative average, have failed more than eight credits of coursework during a term, may be placed on Scholastic Warning, Scholastic Probation, or Dropped for Poor Scholarship at the discretion of the Committee on Standing of Students.

SCHOLASTIC PROBATION

Students on scholastic probation are ineligible for (a) intercollegiate competition and other extracurricular activities in which they publicly represent the university; (b) major office in any university organization; and (c) other activities which require more time than should be diverted from primary purposes by students whose academic survival is at risk. The Dean of Students shall monitor and enforce this ruling.

REMOVAL FROM PROBATION

Students are removed from probation at such time as they meet the standard listed above, effective at the end of any semester or the second summer session.

DROPPED FOR POOR SCHOLARSHIP/REINSTATEMENT STATUS

1) If a student is placed on scholastic probation for the second but not necessarily consecutive term, a review by the Committee on Standing of Students will determine whether the student will continue on scholastic probation or be dropped for poor scholarship.

2) If the conversion of an N, X, or Z grade on the tenth day of instruction makes the student eligible for a change in academic status, the Committee on the Standing of Students will review each individual case to determine the student's status.

3) A student may be granted the privilege of reinstatement for summer session(s) only by the Committee on Standing of Students. The student will be required to present a plan of study endorsed by their advisor and Academic Dean and approved by the Committee on Standing of Students. At the completion of the summer, the student's status will be determined through review by the Committee on Standing of Students.

4) A student may be granted reinstatement for an academic semester on probation by the Committee on Standing of Students. The student will be required to present a plan of study endorsed by their advisor and Academic Dean and approved by the Committee on Standing of Students. At the completion of the semester, the student's status will be determined through review by the Committee on Standing of Students.

UNSATISFACTORY PROGRESS POLICY FOR STUDENTS USING VETERANS EDUCATIONAL BENEFITS

The law requires that educational assistance benefits to Veterans and other eligible persons be discontinued when the student ceases to make satisfactory progress toward completion of his or her training objective. Based on this requirement, any student using Veterans Education Benefits will become ineligible for benefits when dismissed from the university.

Benefits may be resumed if the student is readmitted after at least one semester away. The beneficiary must re-enroll in the same educational institution and in the same program.

When a student fails to maintain prescribed standards of progress the VA will be informed so that benefit payments can be discontinued in accordance with the law. The termination date assigned by the school will be the last day of attendance.

Upon re-certification the school's certifying official should maintain a statement that describes the conditions for the student's continued certification to VA. This may include an academic plan as outlined to the SOS Committee upon petition for readmission. These conditions will prescribe the minimum performance standards to be achieved by the student during the next enrollment/evaluation period.

Academic Grievances

If a student has a complaint about a grade or other academic grievance, the first step is to talk to the instructor involved. If the matter is not settled satisfactorily, the student should contact the department chair or division director about the complaint and submit the complaint through the formal grievance procedure within the department. The final course of appeal for a student, if the student is still aggrieved, is with the appropriate dean.

Course Withdrawal

A student dropping a course within the first ten days of the semester (two days for summer sessions) will have no record of the course on the transcript. A student dropping all courses for which he or she is registered is considered to be withdrawn from the university (p. 31).

A student who withdraws from a course with the approval of his/her advisor and section instructor after the tenth day of instruction and before the end of the eleventh week of instruction will have a grade of "W" assigned to the course.

A Course Withdrawal Form must be initiated by the student by the deadline to be official. Forms must be signed by the student's instructor and advisor and be submitted to the Office of the Registrar. No course may be dropped after the eleventh week of classes during a fall or spring term as noted on the University Calendar. Summer, winter, and fall/spring open learning session length deadlines are prorated based on the length of the class and noted on the University Calendar.

University Withdrawal

An undergraduate student withdrawing from the university (dropping all courses during a given term) must submit the withdrawal request (https://cm.maxient.com/reportingform.php?LehighUniv&layoutid=120) to the dean of students office. Graduate students should review the policies and complete the appropriate form (https://studentaffairs.lehigh.edu/content/withdrawal-leave-absence/) for the Graduate Student Life Office. Withdrawal after registration day will be noted on the academic transcript by assigning a grade of "W" to all courses. The date of the withdrawal will be noted on the academic transcript for a withdrawal at any time during the term.

A student who reduces his or her course load below the minimum required for full time status, but does not withdraw from the university, becomes a part-time student for the rest of that semester. Some areas affected by part-time status are financial aid, athletic eligibility, veterans affairs, immigration status, insurance and loan deferment.

Undergraduate Leave of Absence

Each student is expected to complete the baccalaureate degree by attending Lehigh for four consecutive academic years. Once a student who has matriculated at Lehigh chooses to deviate from this attendance pattern, a revised degree plan, coordinated with his or her advisor and associate dean, must be submitted. Students must submit a request for a Leave of Absence through the Dean of Students. The form must be signed by the student's advisor and the associate dean of the college, and the completed form must be submitted prior to the start of any subsequent enrollment at another college or university.

Current Lehigh University students are prohibited from concurrent enrollment at any other college or university. Courses taken concurrently will not be eligible to apply towards a Lehigh degree. An exception is made for cross registration at another LVAIC institution.

Students cannot assume that a leave will be granted to study at another college or university (this policy does not apply for study abroad through the auspices of Lehigh Abroad or LVAIC programs). The program of study and reason for the leave must be approved by the SOS committee.

If unapproved leaves are taken, students are declared as non-returning and must apply for readmission through the Dean of Students if they wish to re-enroll. Courses taken at another college or university while on an unapproved leave will not be permitted to transfer toward a Lehigh University baccalaureate degree.

In addition, students taking an unauthorized leave of absence must be aware that their eligibility for student aid is jeopardized.

Any student who is uncertain about attending a future fall or spring term at Lehigh University is urged to discuss the matter with the Dean of Students Office prior to taking any action to withdraw or attend another college or university.

Students may take courses at another institution during a summer term without requesting an academic leave of absence. They should check with the Office of the Registrar for limitations and processes for transfer course approval prior to taking the courses.

Release of Final Grades

Grades for undergraduate students are available online as soon as possible following the deadline for reporting of grades using the Banner Student Information System. Current undergraduate students who require a printed grade report for personal use, employment or other purposes can generate reports as needed by going to https://go.lehigh.edu/studentgradereport (https://go.lehigh.edu/studentgradereport/).

Instructors may develop their own policies for release of unofficial reports of academic progress to individual students, or to their advisers, deans, or financial aid officers, on a need-to-know basis, including early release of unofficial final course grades. Any such policies must respect the rights of student privacy in accordance with the Family Educational Rights and Privacy Act.

TRANSCRIPTS

Unofficial transcripts are available through Banner, the student information system, and include the same information as the official transcript. Unofficial transcripts are available to college officials and advisers through Faculty Banner self-service for the purpose of advising.

Official transcript requests must be submitted online through the National Student Clearinghouse (https://tsorder.studentclearinghouse.org/school/ficecode/00328900/), our third-party transcript provider. Please visit the Office of the Registrar website (http://ras.lehigh.edu) for additional information.

Repeating of Courses

A student may repeat a course only twice -- a total of three attempts. Withdrawal from a course counts as an attempt (effective Fall 2017).

If a course is repeated the final grade received upon repetition of the course is counted in the cumulative average. Only the most recent grade and the credit associated with that course and grade counts towards degree requirements. The original grade and associated credit hours received will be excluded from the cumulative average and degree requirements.

A grade that was originally received in a course may not be changed by repeating the course under the pass-fail option.

Overload approval will not be granted for the purpose of repeating a course.

For replacement of a grade from the cumulative grade point average after repeating a course, a student must repeat the identical course with a final grade at Lehigh.

All instances of repeated courses are displayed on the student's academic transcript regardless of repeated status. Students are

responsible for determining any academic or financial implications for repeating courses.

This policy applies to current students only and is not applicable after a student has graduated.

Pass-Fail Systems for Undergraduates

STUDENT OPTION SYSTEM

The pass-fail grading option is intended to encourage undergraduate students to take challenging courses outside the major field. Courses numbered below 100 are generally not available for optional pass/fail grading system. However, the College offering a course may establish a petition process to determine, on a case-by-case basis, whether a student is allowed to take a course numbered below 100 with pass-fail grading. Courses 400 and above are not available for the optional pass/fail grading system.

A student may register for no more than one course pass-fail numbered above 100 and below 400 in any one semester. Students should check the pass/fail restrictions for specific courses. Students may take a maximum of six courses pass-fail per undergraduate career if the student is on a four-year program, or a maximum of eight courses per undergraduate career with a five-year, two-degree program. If a student changes a course from pass-fail grading to regular grading, that course will still count toward the maximum number of courses taken pass-fail during the student's undergraduate career. The optional pass/fail option may not be used for major or minor subject credit toward graduation or for distribution requirements.

Each college faculty shall decide under what conditions and which courses or categories of courses throughout the university may be taken for pass-fail credit by students registered in that college, except for courses designated specifically for pass-fail grading. Each college shall keep the educational policy committee advised of changes in its rules.

A student designates the course(s) to be taken pass-fail normally at preregistration but not later than the fifteenth day of instruction in a regular semester. Summer/Winter session deadlines are prorated according to the length of the session. Prior to this deadline, the student may transfer from pass-fail to regular grading, or vice-versa, without penalty. The courses designated for pass-fail grading by the student require the written acknowledgment of the academic adviser. **Retroactive changes to/from pass-fail grading are strictly prohibited.**

Since the instructor giving the course is not officially notified which students are taking the course pass-fail, a regular letter grade is reported to the Office of the Registrar for the pass-fail students. The student record reflects "P" for reported letter grades from A through D–, and "F" for a reported letter grade of F.

Under this system, the student surrenders their equity to letter grades of A through D–, except as specified below. A grade of P applies to the student's graduation requirements but is not used in the computation of the cumulative average; whereas an F grade is included in the cumulative grade point average.

Acceptance into a program that does not allow pass-fail grading in a course is the only valid reason for converting the grade for a completed course from pass-fail to a letter grade. If a student changes their program such that a course previously taken for pass-fail grading is not allowed for pass-fail grading in the new program, the student must submit a petition to the Committee on the Standing of Students requesting acceptance by the new program, or substitution of the original letter grade submitted, or the substitution of another course. The recommendation of the advisor must accompany the petition.

Courses that cannot be taken pass/fail and are above the 100 level:

- Anth 140 (CogS 140, MLL 140, Psyc 140) Introduction to Linguistics
- Engl 122 Speculative Fiction
- Engl 123 American Literature I
- Engl 124 American Literature II
- Engl 125 British Literature I
- Engl 126 British Literature II
- Engl 155 The Novel
- Engl 157 Poetry
- Engl 163 Topics in Film Studies
- Engl 175 Individual Authors
- Engl 177 Individual Works
- Engl 187 Themes in Literature
- Engl 189 Popular Literature
- Engl 191 Special Topics
- Engl 387 Film History, Theory and Criticism
- Psyc 107 Child Development
- Psyc 109 (SSP 109), Adulthood and Aging
- Psyc 117 Cognitive Psychology
- Psyc 153 (SSP 153), Personality
- Psyc 176 Mind and Brain

NOTE: No Sociology or Anthropology courses numbered 100 or above may be taken Pass/Fail.

Overloads

Overload approval requirements vary by GPA and entry into the University. The following special approvals are required for course rosters (including ranges produced by the drop/add process) that exceed the appropriate normal range.

1) A load exceeding 17 credits is an overload for first semester students. Exceeding 18 credits is an overload for all other students. Unless the normal departmental program requires more credits, required overload approvals by:

Student Status Overloads of:	
First semester students:	Up to 18, Associate Dean
More than 18, SOS	
GPA less than or equal to 3.5:	Up to 19, Associate Dean
More than 19, SOS	
GPA above 3.5 Up to 20, Associate Dean	
More than 20, SOS	

2) Overload approval will not be granted for the purpose of repeating a course.

3) No overload approval will be granted in a semester where the student is enrolled in a graduate course.

4) Any course(s) approved for overload cannot be added until after the end of the normal (three week) registration period. Space in a course cannot be reserved for students intending to add the course as an overload.

Transfer Credit

Transfer of credit from other institutions is the responsibility of the Office of the Registrar. Any students planning to take work at other institutions in the United States or elsewhere should initially check with the Registrar's Office on policies and procedures. Full time students may not be concurrently enrolled at any other institution, except for the LVAIC Consortium cross registered courses, without the advanced approval of the Committee on Standing of Students. Transfer of grades from institutions other than the LVAIC System is not possible.

- Pass/Fail credit/non-credit courses are not acceptable for transfer.
- Courses taken at a two year or four year institution where a grade lower than a “C” has been earned will not transfer. (“C-” or below will not transfer)
- Transfer courses may not be used to delete a prior grade from one’s cumulative grade point average at Lehigh University. Transfer grades are NOT calculated in the Lehigh GPA.
- No student may receive more credit at Lehigh than was granted at the original institution. Courses taken on the quarter system will have credit granted on a 3-2 ratio, no partial credit will be awarded. Courses taken abroad on the ECTS credit system will transfer on 2-1 ratio. The student will receive credit equivalent to the number of credits indicated on the transcript, up to the number of credits for the equivalent course at Lehigh. The Office of the Registrar has the final authority for the amount of credit awarded toward a Lehigh degree.
- No credit will be granted for a course in which the student has already received credit for its equivalent at Lehigh.
- No credit will be granted for continuing education unit courses, correspondence, independent study or any course less than 3 weeks and/or 14 contact hours per credit without the advanced approval of a petition to the Standing of Students Committee.
- Courses must be taken at an institution that is accredited by one of the six regional associations.
- Courses must be evaluated for equivalency and appropriate rigor by the related Lehigh department or college. Transfer courses not equivalent to courses in the Lehigh Catalog may be approved to transfer as general credit (e.g., Dept 099/199/299/399 or UNIV 099) for use toward the Lehigh degree. Departmental elective credit is permitted to carry distribution attributes, where appropriate.
- College and/or departmental transfer credit rules may vary for credits taken prior to matriculation at Lehigh versus those taken following matriculation.

For additional information, visit: https://ras.lehigh.edu/content/current-students/transfer-credit-policy (https://ras.lehigh.edu/content/current-students/transfer-credit-policy/)

TRANSFER CREDIT FOR HIGH SCHOOL DUAL ENROLLMENT PROGRAMS:

Credit for courses completed through high school dual enrollment programs will be awarded only if a course is regularly offered by an accredited two-year or four-year college or university and the enrolled section must have been comprised of both high school and college students. Eligible coursework must also meet the transfer credit policies noted above. Additional verification paperwork is required to begin the transfer credit process.

Students who completed dual enrollment courses that do not fall under the above credit rules may pursue Advanced Placement exams prior to enrolling at Lehigh University, or may consider anticipatory exams during orientation for eligible subject areas.

Course Auditing

A student who is in good academic standing and has not failed any courses in the previous term may be approved to audit not more than one course per semester, which must be outside the curriculum requirements. Application to audit a course is by petition approved by the departmental chair and the Standing of Students Committee. In no case shall a student who has attended a course as an auditor be given an anticipatory examination for credit or register for the same course in the future. A student completing a course in this manner will have the course and the notation AU indicated on the permanent record. A student rostered on an audit basis may be withdrawn from the course with a grade of W for poor attendance. Audit courses do not count toward full-time status.

Review-Consultation-Study Period

The Review-Consultation-Study (RCS) period is intended to provide a period of time for informal academic work between the end of the formal instruction period and the beginning of the final examinations. It is expected that students will use this period to consolidate their command of the material in their courses. Faculty members make themselves available to their students at announced times during this period.

Other than make-ups for missed quizzes/examinations, no quizzes or examinations totaling more than 5% of the final grade shall be given during the last five full class days of each semester except in those laboratory courses ineligible for final examinations.

Graduation Honors

Honors are awarded by vote of the university faculty to those students who have earned a minimum of 90 credit hours in residence at Lehigh University or in programs approved by the faculty to have grades and credit accepted toward the undergraduate degree. Graduation honors are awarded as follows:

Honors: 3.40

High Honors: 3.60

Highest Honors: 3.80

For the purposes of graduation honors calculations, courses taken more than once at Lehigh will only have the most recent grade used in the calculation. Courses taken under the cross-registration policy of the LVAIC and the Washington Semester program will be used.

Students who spend part of their career at another institution, or are transfer admits to degree programs, must have at least sixty earned credit hours of regularly graded (not pass/fail) courses that meet the residency requirement in order to be eligible for graduation honors.

Department Honors

Many departments offer honors work adapted to its curriculum for students who wish to demonstrate unusual academic ability and interest in exploring a chosen field through independent study and research. The precise nature of the program for each student is determined by the academic major department, but may include: unscheduled work or independent study, participation in graduate (400-level) courses, and an honors thesis or project.

Qualified candidates should inform their academic advisers by the end of the junior year of their intention to work for departmental honors. The adviser will give the college and the Office of the Registrar the names of graduating seniors working for departmental honors in particular majors. Student names will be published on the Commencement website.

Honor Societies

There are at least 18 honor and course societies. The three best-known are:

Phi Beta Kappa. The oldest honor society in the United States is represented at Lehigh by the Beta chapter of the Commonwealth of Pennsylvania, the 27th oldest chapter in the nation. The chapter’s council considers for invitation into its membership those students in each of Lehigh’s three undergraduate colleges who satisfy the following profile:

- At least 60 credit hours of coursework completed at Lehigh
- A minimum cumulative GPA of 3.75
- A minimum of 8 credit hours in the natural sciences (including a lab)
- A minimum of 8 credit hours in the social sciences
- A minimum of 8 credit hours in the humanities, especially textual analysis beyond first-year writing (the council typically *does not recognize* some courses that carry Humanities credit at Lehigh, such as Public Speaking, Stage Design, one-credit Music lessons, etc.)
- Calculus or advanced mathematics that requires calculus as a prerequisite
- Two years of college-level foreign language study or its equivalent (may be satisfied by four years of high school study with excellent grades)

- No disciplinary violations sufficient to warrant probation, suspension, or expulsion

Please note: Satisfaction of this profile guarantees consideration by the Phi Beta Kappa council; it does not guarantee election to Phi Beta Kappa. Any undergraduate who has questions about any of the items in this profile should contact Prof. Ziad Munson (https://socanthro.cas2.lehigh.edu/content/ziad-munson/), Executive Secretary of Lehigh's chapter. Office phone: 610-758-3821; e-mail: munson@lehigh.edu

Beta Gamma Sigma. Election to membership in Beta Gamma Sigma is the highest scholastic honor that a student in business administration can achieve. Beta Gamma Sigma is the only national honorary scholarship society in the field of business administration recognized by The Association to Advance Collegiate Schools of Business.

Tau Beta Pi. Tau Beta Pi recognizes engineering students who have a history of distinguished scholarship and exemplary character. The national organization was founded at Lehigh in 1885. A bronze marker in front of Packard Lab commemorates this event.

Among course societies are the following: Alpha Pi Mu, for those in industrial and systems engineering; Alpha Sigma Mu, materials science and engineering (http://www.alphasigmamu.org/). Beta Alpha Psi, accounting; Chi Epsilon, civil engineering; Eta Kappa Nu, electrical engineering; Lambda Mu Sigma, marketing; Omicron Delta Epsilon, economics; Omicron Delta Kappa, leadership; Order of the Omega, leadership in Greek activities; Phi Alpha Theta, history; Phi Beta Delta, international; Phi Eta Sigma, freshman scholastic excellence; Pi Tau Sigma, mechanical engineering; Psi Chi, psychology; Sigma Tau Delta, English; and Sigma Xi, research.

Special Undergraduate Academic Opportunities

The academic programs in the colleges are supplemented by five-year, two-degree programs as well as opportunities for advanced, foreign, and experiential study.

ARTS-ENGINEERING OPTION

The curriculum in arts-engineering is designed for students wanting a professional education in a field of engineering and also the opportunity to study a second field.

Arts-engineers fulfill all requirements for the professional engineering degree for which they are working. However, the first three years of science and engineering courses are scheduled over four years for the arts-engineer. During this period the arts-engineer is a student in the College of Arts and Science pursuing a bachelor of arts or bachelor of science major program.

In many instances it may be advisable to take the two degrees at the end of the fifth year. Arts-engineers working towards the bachelor of science in biology, computer science, environmental science, geological sciences, geophysics, molecular biology, and statistics are advised to pay special attention to the engineering humanities and social science requirements, which must be met in time for the student to qualify for the B.S. in engineering.

Arts-engineers have the same opportunities for multiple majors and special interdisciplinary majors as are available to students working for the baccalaureate (B.S. or B.A. degree only) in the College of Arts and Sciences. Additional information may be obtained by contacting Professor Jenna Lay, Director of Special Programs.

BACHELOR/MASTER DEGREE PROGRAMS (4+1 PROGRAMS)

Lehigh's colleges offer accelerated degree programs that allow students to earn both a bachelor's degree and a master's degree in just five years, rather than the usual six or seven.

Students declare their interest by their sophomore or junior year, and must complete an abbreviated graduate admission application during their senior year.

To see if one of these programs are right for you, please see the appropriate page:

College of Arts and Sciences (p. 60)

College of Business (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/accelerated-program/)

College of Education (p. 334)

College of Health (p. 386)

PC Rossin College of Engineering and Applied Science (p. 400)

Apprentice Teaching

The apprentice teaching program is designed to benefit juniors and seniors who wish to learn about teaching under the guidance of an experienced teacher. Apprentices often do a limited amount of supervised lecturing or leading of discussions, assist in making up and evaluating written assignments, and are available for individual consultation with students.

To participate in the apprentice teaching program a student must:

1. Have an overall cumulative grade point average of 2.80 or better;
2. Have a cumulative major grade point average of at least 3.3 and have completed at least two courses in the major field in which apprentice teaching is done;
3. Have previously taken for credit the course or its equivalent in which the apprentice teaching will be done;
4. Meet the guidelines on file in each college dean's office.

A student may register for apprentice teaching only once each semester, only once in a given course, and only twice during a college career.

To register for apprentice teaching each student-teacher partnership will submit an apprentice teaching agreement, indicating the duties and obligations for approval to the department chair and the dean of the student's college in which the course is taken. Upon review and approval, the student will be provided with the appropriate information to register. To complete the course, the apprentice teachers must submit a written report of their experience to the supervising teacher and the associate dean's office.

Credit by Examination

Upon petition and presentation of evidence that he or she has qualified for it, a student already enrolled at Lehigh may be permitted by the Standing of Students Committee to take a special examination for credit towards graduation. Special examinations are granted only for extraordinary reasons and upon petition. There must be adequate supporting evidence of sufficient cause accompanying each petition. There is a fee for all special examinations.

Students taking a special exam after matriculation at Lehigh will have the grade and credits assigned to their permanent Lehigh record. Special exam credit will be counted as in residence credit and the grade will be used in all grade point average calculations. No special exam will be granted in a course that the student has already taken (except senior reexaminations) for credit or on an audit basis, or in a course in which the student has already completed more advanced work at Lehigh.

Guidelines for Undergraduates to Take Graduate Level Courses

1. No undergraduate student may take 400-level courses during a term where the student's total credits are greater than 18 (including audits).
2. All students receiving a graduate degree must be enrolled one full semester or summer as a regular student prior to the awarding of a graduate degree.
3. An undergraduate student may use no more than 12 credits taken as an undergraduate toward a graduate degree. These courses must be at the 300 and 400 level and beyond all undergraduate degree requirements.
4. Students should have achieved junior standing and a grade point average of 3.0 to take 400 level courses.
5. Students must petition the Standing of Graduate Students and the Standing of Students for permission via the Undergraduate SOS Petition Form.

6. Students requesting a second graduate level course in a given term must petition the Standing of Graduate students committee. (Students enrolled in two graduate courses may not register for more than 15 credits.)

Curricular Flexibility - Transfer Between Colleges

The undergraduate curricula are flexible, designed to accommodate the changing interests and needs of students. Boundaries between colleges are fluid, providing many options in an educational program. For instance, students may take a bachelor of science (B.S.) degree in the College of Business or the College of Engineering and Applied Science with a minor in journalism in the College of Arts and Sciences. There are also five-year programs for which degrees are awarded in two colleges.

Students who wish to transfer from one undergraduate college to another – an intra-university transfer, which at Lehigh is commonly called "college switching" – may do so provided that they have achieved sophomore status and have completed at least 12 credits while in their college of matriculation. Students on academic probation may transfer between colleges with the permission of the committee on standing of students. In addition, each receiving college may require the completion (with a minimum grade of C-) of no more than three introductory courses – courses without prerequisites – before transfer occurs. Students considering such a transfer must confer with their advisers to begin the process.

The College of Business requires a student to successfully complete either MATH 081 or MATH 021, and ECO 001 before transferring to that college. Courses considered equivalent to these courses will also satisfy the requirement such as approved transfer credit (including AP courses) for these courses taken at other institutions, or the successful completion of MATH 075 and MATH 076, or MATH 031, which are equivalent to MATH 021.

A completed Petition to Change Colleges must be submitted no later than three weeks prior to the start of registration for the semester in which they wish to make the transfer.

Students who transfer to another college within Lehigh, or who transfer to an inter-college (IC) program offered jointly by two or more colleges, may require more than the traditional eight semesters to complete the course sequence in their degree program. IC programs may have additional transfer requirements.

Provisional Courses

Instructional departments may introduce provisional courses temporarily within a semester, either experimentally or as a response to a contemporary social or scientific issue. If successful, such courses may become a permanent part of the university curriculum. These courses, identified with a 95, 96, 97 or 98 number (preceded by a 0, 1, 2, 3 or 4 indicating level) may be offered for a maximum of two years.

LVAIC Cross-Registration

Currently enrolled full-time degree seeking undergraduate students in good academic standing who have achieved sophomore status may register for up to two courses per term at any one of the member institutions (DeSales University, Cedar Crest College, Lafayette College, Moravian College, and Muhlenberg College). The student must obtain the appropriate approvals of his or her own adviser and the host institution Registrar. The courses must not be available at the home institution and must be in the normal academic load and not produce an overload. Graduate students and graduate-level courses are not eligible for cross registration.

All grades of courses taken through the LVAIC cross registration process will be accepted by the home institution and entered on the permanent record, and such grades will be used in computing the grade point average. Credits taken through the cross-registration process will be calculated as in-residence. The number of credit hours assigned to a course is the responsibility of the home institution registrar.

Students may not repeat a course at another LVAIC institution with the expectation of a Lehigh cumulative grade point average adjustment.

Lehigh University students are not permitted to cross-register for courses in all January intersession programs, the evening program at Muhlenberg College, all weekend courses at Cedar Crest College, or the Access program at DeSales University. All independent study, tutorial, music lessons or groups, and correspondence courses are prohibited from cross-registration.

SUMMER CROSS-REGISTRATION

Lehigh students must have been registered full time in the prior spring semester to be eligible to cross-register for a summer term. A maximum of two courses per session may be rostered. Students may not cross-register for a course being offered at Lehigh during the summer term.

Additional information on cross-registration can be found on the LVAIC website (http://lvaic.org/for-students/cross-registration/).

General College Division

The General College Division provides an opportunity for qualified persons not planning to seek a degree to pursue work of a general or specialized nature that their preparation and interests make desirable; provides a trial period for those who wish to become candidates for baccalaureate or graduate degrees, but whose preparation does not satisfy the entrance requirements for the established curricula; and provides an opportunity for qualified students to continue their education without being committed to a restricted or specialized program of studies. Courses taken in the General College Division may not be submitted to meet the requirements for a graduate degree.

For admission to the General College Division, the student must submit a special, simplified application to the undergraduate admissions office; the application must be submitted at least *one month prior* to the start of the semester in which the student hopes to enroll. The applicant must show maturity, seriousness of purpose and evidence of ability to pursue with profit the program of studies they desire. The student must have the established prerequisites for courses in which he or she wishes to enroll, and may register for courses up to and including those at the 300-level. 400-level courses are prohibited.

There is no established curriculum for the General College Division. Each student works on a program outlined to meet his or her special needs. Each program must be approved by the Registrar or their designee, who serves as the director of the division. Students must obtain permission of the instructor for each course in which they seek to enroll each semester. Students in this division are granted final approval for enrollment on a case by case and space available basis.

Students in the division are not permitted to take courses using the optional pass/fail grading system, course audit, or cross register for courses in LVAIC.

Students in the division, as non-degree candidates, do not meet the eligibility criteria for institutional or federal student aid, under Title IV, including Federal Pell Grants and Federal Stafford Student Loans.

Students in the division are not candidates for degrees and must maintain a minimum 2.00 grade point average. A student may transfer to regular matriculated undergraduate status in any of the colleges only upon petition to, and with the approval of, the Committee on the Standing of Students. Transfer to the graduate school is possible only through the normal graduate admission process.

With the exception above, students in the General College Division are subject to the same rules and regulations as students of the university. They pay the tuition and fees established for regularly matriculated students.

Graduate Study and Research

HISTORY

Lehigh began awarding graduate degrees in 1882. The first recipient, T.H. Hardcastle, of the Class of 1880, wrote his thesis on Alexander Pope, entitled it The Rights of Man, and read it aloud at commencement in June 1882.

The first Ph.D. was granted in 1893 to Joseph W. Richards, Class of 1886. Richards, who had a background in metallurgy and electrochemistry, taught at Lehigh until his death in 1921.

Women were admitted to the graduate program in 1918 when the faculty and the board of trustees agreed to grant the degrees of M.A. and M.S. to women, provided they attended classes in the late afternoon and on Saturdays "so that the general character of campus life shall not be affected." Three women received graduate degrees in 1921, the first women to complete graduate work at Lehigh. In 1929, the rule was changed, and women were admitted on much the same basis as men.

In 1936, the Graduate School was established to administer the graduate program. The Ph.D., which was temporarily discontinued in 1894, was reinstated in nine departments: chemistry, chemical engineering, civil engineering, geology, history, mathematics, mechanical engineering, metallurgical engineering, and physics. Tomlinson Fort, professor of mathematics, was selected in 1938 as the first dean of the Graduate School.

In 1995, graduate programs were decentralized and are now administered by the individual colleges of the university, as described below.

CREDIT HOURS

Each course is designated a credit value of the course in terms of semester hours ("credit hours").

COURSE NUMBERING

The course numbering system specifies which courses can be applied to the program of study as the student progresses toward the undergraduate or graduate degree. In general, the numbering series is as follows:

- **0-99**. Courses primarily for freshmen or sophomores. Not available for graduate credit.
- **100-199**. Intermediate-level undergraduate courses. Not open to freshmen except on petition. Not available for graduate credit.
- **200-299**. Advanced undergraduate courses. Courses in the College of Business and specific departments as noted in the listings are open to freshmen and sophomores only with permission. Not available for graduate credit in the major field.
- **300-399**. Advanced undergraduate courses. Same as 200-299, but available for graduate credit in major field.
- **400-499**. Graduate-level courses, open to undergraduates only by petition.

COLLEGE OF ARTS AND SCIENCES

Robert A. Flowers, Herbert and Ann Siegel Dean

R. Michael Burger, Associate Dean for Research and Graduate Programs, Professor of Biological Science

The College of Arts and Sciences offers graduate degrees in the humanities, social sciences, mathematics, and natural sciences. The master of arts, master of science, and the doctor of philosophy degrees are given in most of the traditional academic departments and in some interdisciplinary programs. Advanced degrees may be obtained in the departments of biological sciences, chemistry, earth and environmental sciences, English, history, mathematics, physics, political science, psychology, statistics, and an interdisciplinary degree in Environmental policy.

Although degree requirements vary from department to department, most require a combination of formal coursework and independent research. Students work closely with a faculty adviser in formulating and carrying out their research programs. Students admitted to a traditional department who are interested in an interdisciplinary approach may design a program of study and research which draws on faculty and facilities in other areas of the college or university.

For the most up to date information, interested students should check the CAS graduate website (http://cas.lehigh.edu/grad (http://cas.lehigh.edu/grad/)) or contact the Office of Research and Graduate Programs, College of Arts and Sciences, 9 West Packer Ave., Bethlehem, PA. 18015, 610-758-4280 or email to incasgrd@lehigh.edu.

COLLEGE OF BUSINESS

Manoj K. Malhotra, Dean

Xiaosong (David) Peng, Associate Dean

The College of Business is accredited by AASCB International; the Association to Advance Collegiate Schools of Business.

There are six departments in the college: Accounting, DATA (Decision and Technology Analytics), Economics, Perella Department of Finance, Management, and Marketing.

Information on the college's graduate programs may be obtained by visiting the College of Business graduate website (https://business.lehigh.edu/graduate/).

Specialty Master's Degrees

The College of Business offers STEM-designated specialty master's degrees in Applied Economics (https://business.lehigh.edu/academics/graduate/masters-programs/ms-applied-economics/), Business Analytics (https://business.lehigh.edu/academics/graduate/masters-programs/ms-business-analytics/), and Management (https://business.lehigh.edu/academics/graduate/masters-programs/ms-management/). A dual degree program (https://business.lehigh.edu/academics/graduate/masters-programs/dual-degree/) for these 3 programs is available and allows the completion of two degrees in two years. Lehigh undergraduate students may opt for a 4+1 program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-applied-economics/accelerated-program/) that would allow the M.S. in Applied Economics degree to be completed in an accelerated mode.

The College of Business, the P.C. Rossin College of Engineering and Applied Science, and the College of Arts and Sciences offer a master of science degree in Financial Engineering (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/), which provides a strong education in advanced finance and quantitative financial analysis tools. Students will be prepared to create innovative solutions for real financial problems using state-of-the-art analytical techniques and computing technology. Lehigh undergraduate students may opt for a 4+1 program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/accelerated-program/) that would allow the M.S. in Financial Engineering degree to be completed in an accelerated mode.

Master's of Business Administration (MBA)

The master of business administration (MBA) allows full-time or part-time study. The one-year, full-time MBA program (https://business.lehigh.edu/academics/graduate/masters-programs/one-year-mba/) is available with concentrations in business analytics, financial management, marketing, and supply chain management. The part-time FLEX MBA program (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/) offers courses on campus or **online** in a synchronous format and is available with concentrations in business analytics, corporate entrepreneurship, finance, marketing, international business, public health, project management, and supply chain management. The one-year, full-time MBA program (1-MBA) offers a dual degree Master of Public Health program in partnership with the College of Health.

In addition, the College of Business and the P.C. Rossin College of Engineering and Applied Science offer an MBA and Engineering (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-engineering/) degree. Students in this program will have the opportunity to concentrate in both a business area and an engineering area during their studies.

The College of Education and the College of Business offer a joint master's degree in MBA and Educational Leadership (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-educational-leadership/), which will develop skills in business disciplines and prepare educators for roles in school administration.

Doctor of Philosophy (Ph. D.)

The STEM-designated doctor of philosophy degree in Business and Economics (https://business.lehigh.edu/academics/graduate/phd-program/business-and-economics/) is also available. This full-time program can be completed in 5 years. All students accepted into the Ph.D. program are offered funding packages, subject to satisfactory progress, that guarantee four academic years of tuition remission and a monthly stipend (9-month per year) to cover living expenses. Though not guaranteed, almost all students in the past also received funding in their fifth year.

Contact Us

College of Business, Graduate Programs Office
Business Innovation Building, Suite 201
201 E. Packer Avenue, Bethlehem, PA. 18015
Phone 610-758-4450 / Email business@lehigh.edu

COLLEGE OF EDUCATION

William Gaudelli, EDD, Dean

Bridget V. Dever, PHD, Associate Dean for Research

Robin Hojnoski, PHD, Associate Dean for Graduate Studies

The College of Education is a nationally recognized graduate college. Our distinction resides in our ability to function as a community of scholars and teachers. The diversity of our partnerships, the quality of our research and teaching, and the invigorating and supportive learning environment distinguish us as leaders among graduate colleges of education.

The College of Education offers a master of arts in education, a master of education, a master of science in education, the educational specialist, a joint master in business administration/master of education, post-baccalaureate certificates in various concentrations, the doctor of education, and the doctor of philosophy. There are five academic programs within the college including: Counseling Psychology, Educational Leadership, School Psychology, Special Education, and Teaching, Learning and Technology. The focus of these programs is to prepare students for leadership roles in groundbreaking, cross-disciplinary inquiry that shapes educational practices nationally and internationally. While the College of Education does prepare individuals for leadership roles in school systems, we also prepare individuals for a variety of positions in business and industry, healthcare, private practice, and community-based organizations. We embrace the philosophy that a top quality education should provide the instruction, resources, and experience necessary to create a new type of educator; one who understands the nature of learning, social equity and cultural diversity; values collaboration and teamwork; and embraces societal challenges.

In addition to these five core academic programs, there are three other units within the College of Education:

CENTENNIAL SCHOOL

Centennial School is an Approved Private School, governed by Lehigh University and funded by the Commonwealth of Pennsylvania. Centennial School meets the educational needs of students with emotional disturbance and autism as defined under the Individuals with Disabilities Education Act (IDEA). With an emphasis on evidence based practices, Centennial School effectively uses an apprenticeship model to train graduate students in special education and other school-based professions such as school psychology, counseling, and educational leadership. The close partnership between Centennial and the College of Education provides Lehigh graduate students with unique research opportunities and fulfillment of practicum and internship requirements. centennial.coe.lehigh.edu/ (http://centennial.coe.lehigh.edu/)

THE CENTER FOR PROMOTING RESEARCH TO PRACTICE

The center's mission is to generate new knowledge that will truly impact the lives of individuals with or at risk for disabilities and to enhance the translation of new knowledge into practice. All too often research that is created for these individuals remains at the development level and is not disseminated into best practices. The Center is focused on conducting and disseminating applied research and assuring research outcomes get into the hands of parents and practitioners as quickly as possible. https://ed.lehigh.edu/faculty/research-centers/center-for-promoting-research-to-practice (https://ed.lehigh.edu/faculty/research-centers/center-for-promoting-research-to-practice/)

Lehigh University Autism Services is a clinic housed in the Center for Promoting Research to Practice. The mission of the clinic is to develop and disseminate research-based practices that improve the well being of children with autism and their families and to serve the local community. The clinic provides intervention programs for young children with autism spectrum disorders (diagnosis to age 5) and their families. https://ed.lehigh.edu/center-for-promoting-research-to-practice/autism-services-clinic (https://ed.lehigh.edu/center-for-promoting-research-to-practice/autism-services-clinic/)

GLOBAL DISTANCE GRADUATE DEGREES AND TRAINING OFFICE

The Office of Global Distance Graduate Degrees and Training provides online graduate education and training to students in the U.S. and worldwide within Lehigh University's College of Education. The Global Distance Office's international initiatives include offering graduate degree programs, principal certification, non-degree graduate certificates, and summer institutes via online courses and in-person throughout the academic year. Additionally, the Global Distance Office serves as an academic resource to College of Education faculty by working with them to identify research opportunities globally, facilitating partnerships with domestic and international professional organizations, and organizing customized professional development programs at K-12 international schools worldwide. For more information, visit: https://ed.lehigh.edu/distance. (https://ed.lehigh.edu/distance/)

Information on the various degree programs can be obtained by contacting the College of Education, 111 Research Dr., Bethlehem, PA 18015, 610-758-3231 or visiting our website: http://ed.lehigh.edu/.

COLLEGE OF HEALTH

College Leadership

Elizabeth A. Dolan, *Dean*
Won Choi, *Associate Dean for Research and Graduate Education*
Micheal Gusmano, *Associate Dean for Academic Affairs*
Erica Hoelscher, *Associate Dean for Faculty and Staff*

CONTACT INFORMATION

Health | Science | Technology Building
College of Health Administrative Suite
124 East Morton Street
610.758.1800 | incoh@lehigh.edu
website: health.lehigh.edu (https://health.lehigh.edu/)
social: LehighUhealth

Graduate Programs

It is more important now than ever to understand, preserve and improve the health and well-being of populations and communities locally, nationally, and globally -- this is at the heart of the mission of Lehigh University's College of Health. Launched in 2022, College of Health graduate programs prepare students to investigate and address the multiple determinants of health through novel and innovative health research, practice, and policy. The PHD and combined MBA/MPH are full-time only. For all other programs, students may enroll part-time or full-time with flexible class formats of in-person, online or hybrid. Program details may be found here (https://catalog.lehigh.edu/coursesprogramsandcurricula/health/communityandpopulationhealth/#graduatetext). For more information, contact cohgrad@lehigh.edu (%20inchgrad@lehigh.edu).

PHD Population Health	Master of Population Health (MS)
Master of Public Health (MPH)*	4+1 Accelerated Master of Public Health (MPH)
MBA/MPH (with the College of Business)	4+1 Accelerated Master of Population Health (MS)
Graduate Certificate in Population Health	Graduate Certificate in Global Health

+1 Master of Engineering in Healthcare Systems Engineering (with the P.C. Rossin College of Engineering and Applied Science)	Flex MBA with Healthcare Management Concentration (with the College of Business)

*

CEPH accreditation pending

P.C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Stephen P. DeWeerth, dean

John P. Coulter, senior associate dean for research

Derick Brown, associate dean for undergraduate education

Kristen Jellison, associate dean for faculty development

Mark Snyder, associate dean for graduate education

Susan Perry, assistant dean for academic affairs

The P.C. Rossin College of Engineering and Applied Science offers numerous opportunities for graduate study (https://engineering.lehigh.edu/academics/graduate/programs/), both at the master's as well as the doctoral level. Both research-focused, as well as course-only options exist. Degree programs span both disciplinary areas within the academic departments, as well as interdisciplinary areas (https://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinarygraduatestudyandresearch/). Many programs can be taken part-time or through distance education. See this page for more details: https://engineering.lehigh.edu/academics/graduate/programs (https://engineering.lehigh.edu/academics/graduate/programs/).

In cooperation with the College of Business, students can also pursue a Master of Business Administration and Engineering (MBA&E) degree.

Certificate programs (https://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinarygraduatestudyandresearch/graduatecertificatesengineering/) are also available in multiple areas of study.

Graduate study in the P.C. Rossin College of Engineering and Applied Science is most often related to the college's extensive research and scholarship activity. Students pursuing research-based graduate degrees are expected to engage in analytical or experimental research as part of their programs of study. This activity involves students in the process of creating new knowledge under the direction of the college's distinguished faculty and brings them into contact with some of the most modern and advanced experimental techniques. Many college research programs are supported by contracts, fellowships, and grants from industry and from federal, state, and local governments. This funding not only provides financial support for outstanding students but also allows them to deal with some of the more complex and pressing problems facing our society in the 21st century.

Many faculty members and graduate students in the P.C. Rossin College of Engineering and Applied Science are associated with interdisciplinary research centers and institutes as well their own departments. The opportunity for interdisciplinary study allows them to cross departmental lines in specific technological areas and to work with faculty and graduate students from other departments. Information on current research activities can be found at URL https://engineering.lehigh.edu/research (https://engineering.lehigh.edu/research/), as well on on departmental pages.

Further information on the graduate programs may be obtained through the Office of Graduate Studies and Research, P.C. Rossin College of Engineering and Applied Science, 19 Memorial Drive West, Bethlehem, PA 18015, or at engineering@lehigh.edu.

Admission to Graduate Study

A graduate of an accredited college or university may be considered for admission to graduate study. The decision to admit a student rests with the applicant's major department and stands for one year following the first semester for which admission was offered. If more than one year elapses, the prospective student's department reserves the right to reconsider the original offer. Students wishing to pursue an interdisciplinary degree may, in some cases, apply to the program directly.

Applications for admission may be completed online at https://www.lehigh.edu/go/applygrad (https://www.lehigh.edu/go/applygrad/)

An applicant may enter the graduate program as a student in the following categories: regular, associate, or non-degree. Except for qualified Lehigh undergraduates, only those who have been admitted officially by the graduate program office of an appropriate college or by a department in one of the categories above may register for graduate courses or take them for credit.

REGULAR GRADUATE STUDENTS

Only regular graduate students are candidates for graduate degrees. Applications for admission as a regular graduate student must be filed by the required department or program deadlines. Applicants should consult their respective departments or their dean's office. In order to be considered for admission as a regular graduate student, the applicant must satisfy at least one of the following conditions: have an undergraduate GPA of at least 2.75 out of 4.00 (note: College of Education GPA minimum is 3.0); have an average of at least 3.00 for the last two semesters of undergraduate study; have a graduate grade point average of at least 3.00 for a minimum of twelve credit hours of graduate work completed at other institutions; or have successfully satisfied the probationary conditions as an associate graduate student (discussed below). Satisfying one of these conditions is necessary for admission as a regular graduate student but may not be the only condition required.

All graduate applicants are required to show English proficiency. This may be accomplished in a variety of ways including English language testing, a review of previous degree curriculum, interviews or other methods. Please contact your department or program of choice for details about their proficiency policy, methods of satisfying the requirement, acceptable test(s) and associated minimum scores.

Individual departments may evaluate their candidates for admission according to higher standards and additional criteria. Students seeking admission to Professional Certification Programs may have to meet additional requirements to comply with Pennsylvania Department of Education Regulations. Departments should be consulted for information regarding required examinations for admission. In some cases, GRE subject tests are required.

Admission of a student to graduate standing is executed through the Office of Graduate Studies in each college or the respective dean's office.

Completed applications accompanied by requests for university awarded aid must be submitted by January 15 for admission in the following fall semester. (Some departments have earlier deadlines.) Applications received after the deadline will be considered on a space-available basis.

ASSOCIATE GRADUATE STUDENTS

Associate graduate student status may be offered to applicants who apply but fail to qualify for regular graduate student status. Applicants should consult their respective departments.

Associate graduate students are allowed to take up to nine credits of coursework numbered 300 or higher before they must petition for regular student status. In order to be granted regular student status, they must have completed those nine credits with at most one final course mark below B-. Associate graduate students receiving a final course mark lower than a C- will be dropped from the program. Students should note that individual departments may impose more rigorous probationary standards. For example, the College of Education has more stringent probationary standards; please see the handbook for details.

When the probationary period of nine credit hours is completed, associate graduate students must petition for regular student status in order to enroll for additional coursework. Such a petition requires the submission of any regular admission documents not already on file. Courses completed during a successful probationary period

may count toward a graduate degree if they are part of an approved program.

NON-DEGREE STUDENTS

Students may seek enrollment in graduate courses with non-degree status. Students in this category are generally seeking admission to a certificate program or evaluating their ability to formally enroll in a degree program. Prospective non-degree graduate students must complete an application through the online application process: https://www.applyweb.com/lehighg/index.ftl (https://www.applyweb.com/lehighg/) The admissions criteria for non-degree graduate students are: 1) a bachelor's degree from an approved institution with an overall grade point average of at least 3.0 (applicants with undergraduate GPAs below 3.0 may be admitted with the approval of the department in which they wish to take courses); or 2) evidence that the applicant is presently a student in good standing in an appropriate graduate program at an approved institution; or 3) evidence that the applicant has received an appropriate graduate or other advanced degree from an approved institution. In addition, non-native English speakers are required to demonstrate English language skills equal to those required of degree-seeking students and are held to the same English proficiency standards. In some programs, non-degree students must receive permission from the course instructor or program director before enrolling. Requirements may vary by college.

Admission decisions for non-degree students are made by the dean of the appropriate college or other responsible official designated by him/her for this purpose. The signature of the designated official on the application and registration forms confers admission to the non-degree graduate student status. Informal transcripts will be accepted for initial admission, but formal transcripts must be on record before the student can receive any transcript or grade report from the university or enroll for additional courses. Non-degree students must abide by Lehigh's student code of conduct.

Additional Non-degree Options

There are two additional non-degree options:

(1) Students may take as many courses as they wish towards professional development/personal enrichment.

(2) Students may take courses for external certification. Students pursuing external certification will complete coursework for the appropriate certification, with the number of credits dictated by the external accrediting agency. Given this external control of credit requirements, the number of credits will vary.

In some programs and within limits, students may apply non-degree courses towards a degree. Students who wish to apply credits taken as a non-degree student to a degree must apply for formal enrollment in a graduate program after no more than 12 credits of graduate coursework. Further, no more than 12 credits taken as a non-degree student may be applied to any graduate degree. Note that all coursework applied to a Master's degree must be completed within a 6-year timeframe. Non-degree students seeking admission to a degree program must submit all the components required for admissions consideration by that degree program and must meet the required criteria for the degree. Students should consult their respective college dean's office for proper procedure.

GRADUATE COURSE AUDITING

With the permission of the departmental chair, graduate students can be admitted to a course as auditors. This course will not count for credit towards any graduate degree, and may not subsequently be taken for credit. In no case shall a student who has attended a course as an auditor be given an anticipatory examination for credit or register for the same course in the future. A student completing a course in this manner will have the course and the notation "AU" indicated on the permanent record. A student rostered on an audit basis may be withdrawn from the course with a grade of "W" for poor attendance.

LEHIGH UNIVERSITY UNDERGRADUATES

A Lehigh undergraduate with a 3.0 cumulative grade point average who has achieved Junior standing may request permission to take a 400-level course for which she or he is qualified. The qualifications are defined by the department and are certified by the course instructor and department chairperson through a petition to the Graduate and Research Committee. Additional information on constraints on undergraduates taking graduate-level courses can be found in Guidelines for Undergraduates to Take Graduate Level Courses (p. 34).

Undergraduates at Lehigh who wish to take graduate-level coursework should follow the guidelines found here (http://catalog.lehigh.edu/undergraduatestudies/guidelinesforundergraduatestotakegraduatelevelcourses/). Lehigh undergraduates may apply up to 12 course credits taken in the undergraduate program toward a graduate degree under the following conditions: 1) the course credits are not submitted as part of the requirement for an undergraduate degree; 2) approval is granted by the graduate program director, department chairperson and the dean of the college or their designee. The student must receive a final course mark of B- or better. Students should submit a Petition to Reserve Credits For Graduate Degree form with the required approvals.

Accelerated 4+1 Bachelor/Master degree programs are available in each college. Interested students can find additional information on the Special Undergraduate Academic Opportunities (https://catalog.lehigh.edu/undergraduatestudies/specialundergraduateacademicopportunities/) page.

READMISSION

A student who has not been registered in a Lehigh graduate program for one year must petition for readmission. Petitions approved by the student's major department must be forwarded to the Office of the Registrar. The procedure may vary by college.

INTERNATIONAL STUDENTS AND SCHOLARS

International applicants must hold an American bachelor's degree or the equivalent from a foreign institution of higher education. International applicants applying for regular graduate student status must submit all documents required for that status, as outlined in the respective college's admission policies.

Registration

REQUIREMENTS

All graduate students using Lehigh University resources must be registered. The maximum roster of a full-time (no employment) graduate student shall not exceed 18 credit hours, but students can petition to SOGS for up to 20 credit hours. Graduate students who are full-time employees at the university may not take more than six semester hours of graduate work in any one semester. Graduate students who are half-time employees of the university (e.g., half-time teaching assistant or half-time research fellows) may not take more than ten semester hours of graduate work in any one semester. Graduate students under contract to devote not more than one-third of their time to university employment may take a maximum of twelve semester hours in any one semester. Graduate students who are employed elsewhere and can give only part of their time to graduate work must restrict the size of their rosters accordingly. Full time status is indicated for graduate students who register for a minimum of nine credit hours each semester, or three credit hours in each summer session.

REGISTRATION PROCEDURE

Registration is scheduled to begin in November and April at a time designated on the university calendar. Students should check with their departments for registration and semester class schedules. Graduate students register using the online system after consultation with their adviser. A course adviser will discuss course selections with students and provide the registration PIN.

LATE REGISTRATION PENALTIES

Registration after the designated period during the prior term for continuing full-time graduate students will require a late registration fee. Students who have not completed the registration process by the tenth day of the regular academic semester or by the fourth day of the summer session will not be permitted to attend class.

FULL-TIME STATUS

In order to maintain full-time enrollment status, a graduate student must register for a minimum of nine credits each semester. Full-time students may not be employed full-time. Identification as a full-time student is important for three purposes:

1. eligibility for financial aid,
2. compliance with visa requirements for international students, and
3. for university and national graduate enrollment data.

Full-time status may be maintained with fewer than nine credits of registration after fulfillment of degree credit-hour requirements and continuing a program of full-time study and research. In such cases, the status must be certified each semester on the Graduate Full Time Certification request form, first by the department and then by the appropriate college and filed no later than the 5th day of class in the semester in which certification is requested.

Graduate Credit and Grades

Course grades are defined as for undergraduates (p. 29) except that, at a minimum, no final course mark lower than C- may be counted toward a graduate degree and courses designated as pass-fail, and graded P may count toward the degree, within limitations of the program requirements (P grades do not affect the GPA). No regularly admitted student who receives more than four final course marks below a B- in courses numbered 200 or higher is allowed to continue registration as a graduate student. Individual degree programs may have higher standards.

The N grade is defined as for undergraduates (p. 29) except that, parenthetical grades are not required for thesis or research courses and graduate students have a calendar year to remove course incomplete grades unless an earlier deadline is specified by the instructor. Graduate student incomplete course grades that are not removed remain as N or N (grade) on the student record for one year. After one year, the N grade will be converted to an F and the N (grade) will be converted to the parenthetical letter grade. Incomplete grades may be extended an additional year with approval of the course instructor and the graduate coordinator. After two years, outstanding incomplete grades will be converted to an F or the parenthetical mark. After two years, students may appeal to the Committee on Standing of Graduate Students (SOGS) with a timeline and plan for completion. Thesis or research project N grades may remain beyond one year until the work is completed.

The grade SP may be assigned for coursework or projects that do not conform to standard terms (e.g., thesis, research courses, open learning, or multi-term project based learning coursework, etc.) when the student is making satisfactory progress; otherwise, the student should be assigned F. An SP grade will not be converted automatically but rather will remain until changed by the instructor or department chair when instructor is not available. SP grades count towards credits completed but do not affect GPA until converted.

The X grade is defined as for undergraduates (p. 29) except that to be eligible for a make-up examination a graduate student must file a petition and the petition must be approved by the Committee on Standing of Graduate Students (SOGS). The instructor schedules and administers the make-up exam.

The Z grade is defined as for undergraduates (p. 29) except that graduate students have a calendar year to complete coursework following a Z grade unless an earlier completion deadline is specified by the instructor. The X portion of the grade is removed as described for undergraduates. Z grades which are not removed remain on the record of graduate students. All petitions for exceptions are sent to the Committee on Standing of Graduate Students (SOGS).

REPEATED COURSE POLICY

If a graduate student repeats a course, each time that course is taken it is included in the academic record, as is the final grade assigned, and both appear on the official student academic transcript. All final course grades assigned are included in the calculation of the student's cumulative grade point average. Course credits from a repeated course, however, count only once toward satisfying graduation credit requirements.

A student may repeat a course only twice -- a total of three attempts. Withdrawal from a course counts as an attempt (effective Fall 2017).

WITHDRAWAL FROM A COURSE

When a student drops a course within the first ten days of the semester (four days for summer sessions) no indication of this action is recorded on the academic transcript. A student that drops all courses for which he or she is registered is considered to be withdrawing from the university.

A student who withdraws from a course after the tenth day of instruction and before the end of the eleventh week of instruction will have a final course mark of “W” assigned to the course. This is a non-punitive grade.

A Course Withdrawal Form signed by the student’s advisor must be submitted to the Office of the Registrar before the deadlines to be official. No course may be dropped after the eleventh week of classes during a term as noted on the University Calendar.

POLICY FOR TRANSFER CREDIT TOWARDS A GRADUATE DEGREE

Transfer of credit from other institutions is the responsibility of the Office of the Registrar. Graduate students planning to take work at other institutions in the United States or elsewhere should initially check with the Registrar's Office on policies and procedures. Current graduate students may not be concurrently enrolled at any other institution without prior permission from the Standing of Graduate Students (SOGS) Committee. Transfer of final grades from other institutions is not possible; only the approved credits transfer. #

- Pass/Fail courses are not acceptable for transfer. #
- Credits may not be transferred toward a Lehigh doctoral degree. #
- Courses must be taken with graduate student status; courses taken under a limited/non degree seeking, continuing education, or simply post-baccalaureate status are not eligible. #
- Courses must be designated at the graduate level and not have been used toward any prior degree. #
- Advanced undergraduate courses are not eligible for graduate degree credit. #
- Only courses for which the student received a final mark of “B” or higher will transfer. Courses for which the student received a final mark of “B-“or below will not transfer. #
- Students may receive credit at Lehigh equivalent to that which was granted as indicated on the transcript of the other college/ university, but only up to the number of credits for the equivalent course at Lehigh. Courses taken on the quarter system have credit granted on a 3- to-2 ratio, producing a whole number for the transfer credits (for example, 10 quarter credits of approved coursework become 6 credits at Lehigh, not 6.67).

The Office of the Registrar determines the number of credit hours awarded upon receipt of the official transcript.

GRADUATE STUDENT SCHOLASTIC REQUIREMENTS

The following guidelines state the minimum requirements for all graduate students. Individual degree programs may have higher standards.

Associate and Non-Degree Students

Associate and Non-Degree Students will be placed on probation when they receive their first final course mark below a “B-” and will be dropped for poor scholarship at the end of a term when the student has accumulated either two “C”, “C-” or “C+” final course marks or one final course mark below “C-”.

If an associate student is assigned two grades below a “B-” in the same term the student is eligible to be dropped without any term on probation.

Once on probation, students remain on probation until they are granted regular status or receive degree. Students who are eligible to be granted regular status but fail to apply by the regular student deadline will be evaluated according to the regular student criteria.

Regular Students

Regular Students will be placed on probation at the end of the term in which they are assigned their fourth final course mark below a “B-” in courses numbered 200 or above and will be dropped for poor

scholarship at the end of any term in which they are assigned their fifth final course mark below a “B-”.

Once regular students are placed on probation they will remain on probation until they receive their degrees.

Readmission

Graduate students who have been dropped for poor scholarship are ineligible to enroll for the next regular term. After one term away they may petition for readmission. The department and the dean’s office must review the petition. If approved, the student will be readmitted on probation and may be dropped again with any additional final course marks below a “B-”.

Academic Grievances

If a student has a complaint about a grade or other academic grievance, the first step is to talk to the instructor involved. If the matter is not settled satisfactorily, the student should contact the department chair or division director about the complaint and submit the complaint through the formal grievance procedure within the department. The final course of appeal for a student, if the student is still aggrieved, is with the appropriate dean.

Graduate Leave of Absence

During the course of graduate study, students may find themselves in circumstances that require them to interrupt their graduate work. When these occasions arise, the University allows students to request a leave of absence for either personal or medical reasons. The information provided below is designed to assist students in making a smooth transition away from graduate study and then back again.

Students are required to submit the Leave of Absence Request form (http://lehigh.edu/go/gradloa/) to the Office of Graduate Student Life. If the student is eligible, the Office of Graduate Student Life will then notify the academic adviser, program director, department chair, graduate associate dean of the appropriate college and the Office of the Registrar. In order to enhance their successful return to graduate school, students are strongly encouraged to meet with their advisers as early as possible and no later than 30 days prior to return to discuss plans and to keep the lines of communication open.

Please note that a “withdrawal” indicates the student intends to discontinue graduate study and should fill out the Graduate Permanent Withdrawal Form (https://cm.maxient.com/reportingform.php?LehighUniv&layout_id=103). The “Leave of Absence” indicates that the student intends to return at a specified later date. This policy addresses leaves after which the student intends to return and resume his or her studies.

Important Information about Requested Leaves of Absence:

- Students who ask to withdraw from classes within the first two weeks of the semester of their first year should request a deferral of admission, not a leave of absence.
- Funded students who are requesting a leave due to the birth or adoption of a child should apply for a Graduate Student Parental Leave. Students can access information and the form here (https://provost.lehigh.edu/resources/policies/policies-graduate-research-and-teaching-assistants/graduate-student-parental/).
- The University will grant a leave of absence for up to one year. If more time away is required, students may request a second year of leave by submitting an additional leave of absence request form. Should students require more than two years away from the University, they will be required to apply for readmission to the program at the end of their time away. A leave that commences during the semester will count as an entire semester away in terms of total leave time allowed.
- Students may be eligible for a prorated tuition refund. Please consult the Bursar’s Office (https://catalog.lehigh.edu/informationofgeneralinterest/refundsofcharges/#:~:text=Prorated%20refunds%20are%20based%20upon,granted%20any%20housing%20rental%20refund) for details.
- An approved leave of absence stops the student's time to degree clock for the length of the approved leave, up to the maximum allowable two years. Students are encouraged to consult their graduate dean's office for time to degree details.
- Students requesting a leave for medical or psychological reasons must include documentation from their health provider which indicates a recommendation for the leave and expected time away. The documentation is submitted to the Associate Deputy Provost for Graduate Education. Such documentation remains confidential.
- While on an approved leave, students are not registered with the University. This has important implications:
  - Students may not submit work, take exams, propose or defend theses or dissertations, or use faculty time.
  - Students will not have access to University services, including the Health and Counseling Centers and the Fitness Center.
  - Students will have access to their email account and to LTS services.
  - Funded students cease to receive stipend payments from the start of the approved date of the leave. Students receiving funding provided to the university by external grants or contracts should consult with their funding-related adviser/supervisor about applicable rules, procedures and possible limitations. While those who have provided financial support for students who go on leave will do their best to support those students when they return and resume their studies, it is not possible to guarantee such support will be available when the student returns.
  - Student loans may come out of deferment and the student may be required to begin repaying his/her loans. Please consult the Office of Financial Aid (https://www2.lehigh.edu/financial-aid/graduate/).
  - Immigration status may be affected for international students. Please consult the Office of International Students and Scholars (https://global.lehigh.edu/oiss/current-students/maintaining-status/).
  - Students living in campus housing will need to make other living arrangements, since only registered students are eligible for campus housing. Housing Services also cannot guarantee space upon the student’s return.
  - All students enrolled in the University health insurance plan are required to pay their annual premium in full regardless of their registration status. This means that any unpaid premium will be due by the first day of leave. This ensures that students on leave have access to health insurance during the term of the health insurance contract. Students can contact the University Health Center (https://studentaffairs.lehigh.edu/node/2554/) to obtain a list of primary care doctors in the community to use during their leave of absence. Please see the Lehigh University Student Health Insurance Plan information (https://www.universityhealthplans.com/letters/letter.cgi?group_id=4).
- Students who need to be absent within the semester (no more than a few weeks in duration) must consult with their professors about the possibility of making up missed classwork and, if applicable, work related to their funding support. In these circumstances, students do not need to submit an official Leave of Absence request. Please also review the Graduate Vacation/Personal Time Away Policy. (https://provost.lehigh.edu/resources/policies/policies-graduate-research-and-teaching-assistants/graduate-vacationpersonal-time/#:~:text=The%20current%20vacation%20policy%20is,time%20away%20can%20be%20paid) Students may consult the Associate Deputy Provost for Graduate Education with questions and concerns.
- Important Information about separation from the university due to failure to request a leave of absence:
  - Students who have spent two years or less away from graduate study without an approved leave may need to pay a maintenance of student status or maintenance of candidacy fee for each of the semesters that they have been

absent as a condition of readmission. The student will need to Petition to the Standing of Graduate Students (SOGS) Committee (https://ras.lehigh.edu/sites/ras.lehigh.edu/files/pdf/SOGS%20Electronic%20Petition%205-2013.pdf) to request readmission.

- Students who have spent more than two years away from graduate study without an approved leave must pay a maintenance of student status or maintenance of candidacy fee for each of the semesters that they have been absent as a condition of readmission. The student will need to Petition to the Standing of Graduate Students (SOGS) Committee (https://ras.lehigh.edu/sites/ras.lehigh.edu/files/pdf/SOGS%20Electronic%20Petition%205-2013.pdf) to request readmission.

- Important Information about separation from the university due to Code of Conduct Violations:
  - Students may be suspended for violating the University's Code of Conduct.
  - Time-to-degree deadlines are not extended for students who are suspended due to Code of Conduct violations.
  - Students who intend to return after a period of suspension are required to submit a petition to the Standing of Graduate Students Committee requesting permission to return.
- When ready to resume graduate study, students are required to complete the Graduate Return from Leave Form (https://publicdocs.maxient.com/reportingform.php?LehighUniv&layout_id=111).
- Returning students are encouraged to contact their program adviser as early as possible to discuss registration.
- Returning students may only re-enroll for a full semester or summer session. In order to meet this requirement, such students need to be aware of registration deadlines.
- If you have any questions about this policy or its application, please contact the Associate Deputy Provost for Graduate Education, Kathleen Hutnik, either by email kaha@lehigh.edu or telephone 610-758-3648.

Returning from Leave and Resuming Graduate Studies

Graduate Withdrawal Non-Returning

If you have decided to terminate your graduate program without intention of returning, please fill out the Graduate Permanent Withdrawal Form (https://cm.maxient.com/reportingform.php?LehighUniv&layout_id=103).

We also ask that you contact either the associate deputy provost for graduate education and life (610-758-4722) or your college graduate associate dean. We would like to talk with you about your decision and answer any questions you might have.

Please note: if you plan on suspending your program with the intention of returning, please read the Graduate Leave of Absence Policy (http://catalog.lehigh.edu/graduatestudyandresearch/graduateleaveofabsence/) and complete the Graduate Leave of Absence Form (https://cm.maxient.com/reportingform.php?LehighUniv&layout_id=101) instead.

Graduation

DEGREE REGISTRATION

A student must be registered in the semester in which the degree is conferred. If a student is not registered for a course, he/she must register for maintenance of candidacy. Candidates for August degrees do not need to be enrolled the summer preceding the degree if they were enrolled both fall and spring of the previous academic year.

APPLICATION FOR DEGREE

Candidates for graduation on University Day in May must apply on or before February 1; candidates for graduation in August must apply on or before July 1; candidates for graduation in January must apply on or before October 1. Students must apply online using the Banner Student Information System.

Applications submitted after the specified deadline will be charged a late application fee. No applications will be accepted within three weeks of the graduation date. Students who fail to submit an application must apply for the next available degree awarding date.

CLEARANCE

Graduate students must receive clearance from the university prior to the awarding of the degree. The following obligations must be satisfied:

- Students must complete all coursework, including any incomplete grades they may have received.
- Theses must be cleared by the appropriate dean's office.
- Dissertations must be cleared by the appropriate dean's office.
- All financial obligations must be cleared with the bursar. Tuition fees, bookstore charges, library fines, and motor vehicle fines must be paid before graduation.
- All library books on loan must be returned.
- The interdepartmental clearance sheet must be completed and reviewed with the department coordinator in which the student has studied.

Tuition and Fees

TUITION PAYMENT

Graduate students who register at least six weeks prior to the start of classes will receive an email notification to their Lehigh email account that their tuition bill is ready to view online at the e-Bill Suite. Students that register less than six weeks prior to the start of classes will most likely not have a tuition bill generated prior to the start of classes. Late registration does not excuse the student from satisfying financial obligations by the announced semester due dates. Students registering after the announced semester due date should be prepared to satisfy their financial obligations at the time of registration. Students can review their current account balance online 24/7 by logging into the e-Bill Suite or the Campus Portal. Information about the various payment options is available at the Bursar's Office web site at www.lehigh.edu/inburs/ (http://www.lehigh.edu/inburs/) or by calling the Bursar's Office.

TUITION REFUNDS

A student in good standing who formally withdraws or drops a course(s) before 60% of the semester has been completed is eligible for a tuition refund. Academic fees are non-refundable after the first day of classes. **The "first day of classes" is considered the first day of the semester, not the first day a particular class meets.** Courses not following standard semester dates will have percent-of-semester-completed refunds based on dates for that specific course. Online courses percent-of-semester-completed are based on access availability, not if/when student first accessed course material. No tuition refunds will be made for courses of one week or less after the first day of class.

TUITION AND FEES FOR 2024-2025 PER CREDIT HOUR

College of Arts & Sciences	$1,590
College of Business & Economics	$1,340
College of Education, and for fulltime elementary and secondary teachers and administrators enrolled in the other three colleges	$630
College of Engineering & Applied Science	$1,590
College of Health	$1,590
Special Programs MBA & Engineering	$1,590
MBA/Educational Leadership	$975
MS/Analytical Finance	$1,590
MS in Business Analytics	$54,150
M² - Masters of Science in Management - 9 month program (30 credits)	$54,150
Accelerated MBA (1-year)	$68,900
Audit charge per course – same as credit charge in the appropriate college	

Maintenance of candidacy – same as a one-credit charge in the appropriate college	
Master's candidate registration fee – same as a onecredit charge in the appropriate college	

LIVING ACCOMMODATIONS

The university maintains a graduate student housing complex in the Saucon Valley that has 135 living units. This complex, Saucon Village Apartments, provides units generally on a yearly lease basis. For the 2024-2025 period beginning in September, the following are the monthly rents exclusive of utilities:

Efficiency apartment	$830
One-bedroom apartment	$930
Two-bedroom apartment	$1,070
Three-bedroom apartment	$1,160

230 W Packer\Packer House Rent

The university also maintains graduate housing on the Asa Packer campus. 230 W. Packer and Packer House provide single bedrooms within small houses where residents share bathrooms and a common kitchen. These rooms are provided on a yearly basis. For the 2024-2025 period beginning in September, the following are the monthly rents:

Small Bedroom	$710
Large Bedroom	$730

OTHER FEES

Application fee	Consult with individual college (for graduate admission consideration)
Wellness Fee	$220
Late pre-registration [1]	$100
Late application for degree	$50
Late payment (after announced date)	$200
Returned check fine	$35
Identification card (replacement)	$30
Thesis distribution	$55
Dissertation distribution	$90
MBA Orientation Fee	$375
MS Orientation Fee	100
Supervision fee [2]	$175 to $525

1

Assigned to full-time graduate students who do not select their full class load during the designated period each term.

2

College of Education (per 3 credits) Intern courses require a special supervision fee which varies from $175 to $525. Inquire in your department.

Financial Aid

Financial aid is available only for regular, full-time graduate students. Teaching assistantships, research assistantships, graduate assistantships, fellowships, and scholarships are academic awards made by individual academic departments. Several graduate assistantships unrelated to a particular area of study can be obtained by applying to administrative offices. International students are also encouraged to apply for funding to outside sponsoring agencies and/or home governments. Finally, please note that all student loan programs are administered by the Office of Financial Aid located at 27 Memorial Drive West. (Please read the section below regarding loans and work-study.)

ACADEMIC AWARDS

Requests for fellowships, scholarships, research assistantships, teaching assistantships, and graduate assistantships to begin in the fall semester must be filed with academic departments no later than January 15. (Some departments have earlier deadlines.) Generally, a special committee formed by department faculty selects the recipients of these awards based upon merit; students are not required to submit a financial statement.

In addition to their stipends, graduate students holding half-time teaching appointments generally receive tuition remission. Fellowship holders also receive a stipend and tuition award. Scholarship recipients are awarded tuition. Research assistants receive a stipend for research services, but their tuition is commonly paid directly by research projects.

TEACHING ASSISTANTS AND GRADUATE ASSISTANTS

Teaching assistant and graduate assistant (TA/GA) are technical terms used to describe specific types of Lehigh University graduate students. The duties of TAs and GAs are generally set by the departments or offices that appoint them, but certain conditions must be satisfied before a student can be classified as a teaching assistant or a graduate assistant. These include:

- Each TA/GA must be a regular full-time resident Lehigh graduate student, which normally requires registration for at least nine credit hours per semester.
- A TA/GA is a half-time position and each TA/GA provides services to Lehigh University of up to twenty hours per week. Quarter-time and eighth-time TA/GA appointments are possible for full-time resident graduate students, with stipends and tuition remission appropriately reduced.
- Each TA/GA must be paid a specific stipend, which is set for the academic year by the dean of the appropriate college after consultation with the Director of Budget.
- Qualified TAs/GAs receive tuition remission for at most ten credit hours in a regular semester. No TA/GA may register for more than ten credit hours. A student who is a TA/GA during the preceding academic year is entitled to at most three hours of thesis, research, or dissertation registration (not course credit) in the following summer without payment of tuition (except in the College of Education).
- Each TA/GA is appointed by a process which begins with a formal letter of appointment issued by the appropriate department chairperson. The appointment letter specifies standard university conditions including stipend level, time of arrival, length of service, and the requirement of satisfactory academic progress and performance of duties. Each department chairperson submits written notification of TA/GA appointments to the appropriate college dean or vice president.

The Graduate and Research Committee endorsed academic guidelines for new teaching assistants which exceed minimum admission requirements. Each TA should satisfy one of the following: have a GPA of 3.0 or better in the undergraduate major field of study; have a GPA of 3.5 in the senior year major field; rank in the 85th percentile or higher on the Graduate Record Exam or other standardized test; or have a GPA of 3.5 in at least twelve hours of graduate work in the major field. Exceptions to these guidelines shall be made only with the approval of the appropriate dean.

In addition, each teaching assistant must make normal progress toward a graduate degree. The definition of normal progress may vary among departments, but the criteria for satisfactory progress are established by the department faculty and the Graduate and Research Committee. Teaching assistants who fail to satisfy these criteria are ineligible for reappointment.

In addition to achieving the minimum TOEFL iBT scores necessary for admission, potential Teaching Assistants and Graduate Assistants whose first language is not English who will be working with Lehigh undergraduates in academic settings (classrooms, recitations, labs, office hours, etc.) must pass Lehigh University’s Test of Presentation and Speaking Skills (TOPSS) prior to beginning their instructional responsibilities. At the Department’s discretion, students who score in the conditional range on the TOPSS may be appointed as a TA or GA but will be required to attend English as a Second Language courses, re-take the TOPSS, and achieve a passing score within one semester.

Tuition remission for qualified TAs/GAs is authorized by the appropriate dean or vice president as part of the registration process. Each college dean or appropriate vice president will be provided tuition remission accounts against which TA/GA remissions will be charged. The accounts will be budgeted at an amount equal to the nine-hour TA/GA tuition rate times the approved number of TA/GA positions and will be included in the annual operating budget. The budgets shall not be exceeded. If additional TA/GA positions are desired on a temporary basis, the account executive must provide for the transfer of budget support to the remission account. These budgets are to be used exclusively for tuition remission for authorized TA/GA positions.

There are a limited number of summer TA/GA appointments. These TA/GAs must receive the same monthly stipend as academic year TAs/GAs and devote up to twenty hours per week to the GA/TA responsibilities. A summer TA/GA registers for a maximum of three credit hours in each summer session of appointment and receives tuition remission for that registration.

OTHER GRADUATE ASSISTANTSHIPS

Graduate students may apply directly to administrative offices for graduate assistantships unrelated to their areas of study. The availability of these assistantships is based upon the needs of the individual departments. GAs are appointed regularly by the office of the vice provost for student affairs, the dean of students office, the university counseling service, and by career services.

LOANS AND WORK-STUDY AWARDS

Graduate students may apply for Federally funded loans (Direct Unsubsidized Loan or Graduate PLUS Loan) through the Office of Financial Aid. Federal funds are awarded using the Free Application for Federal Student Aid (FAFSA) which can be completed on the web at www.fafsa.ed.gov. In addition to the FAFSA, you should complete the Graduate Student Financial Aid Application to provide the financial aid office with important information about your enrollment plans.

Eligibility for student loans is based on the number of credits to be taken and the total amount of assistance received. Any change to the number of credits to be taken or the amount of aid received may affect loan eligibility. To avoid problems with your loan application, it is important that you notify the Office of Financial Aid of any changes in your enrollment or in the amount of aid received. It is the student's responsibility to notify the Office of Financial Aid of any changes.

Visit the Office of Financial Aid website for additional information: www.lehigh.edu/financialaid

Degree Information

The following degrees are offered by the university: the master of arts, the master of business administration, the master of business administration and educational leadership, the master of business administration and engineering, the master of education, the master of engineering, the master of science, the doctor of philosophy, the doctor of education, the doctor of arts, and the education specialist.

Students pursuing multiple graduate level degrees must meet minimum unique degree credit-hour requirement for courses taken at Lehigh. A single master's degree requires a minimum of 30 credits (see transfer credit policy for any exceptions); a single doctoral degree requires a minimum of 72 credits, or 48 for a student with a prior master's degree. No credit used for a master's degree may be counted towards reducing the minimum requirement of 48 Lehigh credit hours for a doctoral degree.

Candidates for the master's degree have six years in which to complete their programs. Students should confer with their advisers to be certain that specific department and program course requirements are met. The following requirements must be satisfied by master's candidates in all departments.

PROGRAM FOR THE MASTER'S DEGREE

A student's program must include: not less than 30 credit hours of graduate work; not less than 18 credits of 400-level coursework (research or thesis registration counts as part of the 400-level coursework requirement); and not less than 18 credits of coursework in the major, of which 15 credits must be at the 400 level. Coursework for the master's degree must be taken under at least two instructors and must be approved by Lehigh University. With the approval of the department chair, between 9 and 15 credits of graduate coursework taken elsewhere may be transferred to a Lehigh master's program. The number of credits that may be transferred depends on the number of credits in the master's program: Up to 9 credits for programs of 36 credits or less; up to 12 credits for programs of 37 to 48 credits; and up to 15 credits for programs of 49 to 60 credits. Programs, departments and colleges may have more restrictive transfer rules, however, and students should consult their program offices to learn of any such restrictions.

Course transfers require submission of completed course-transfer petitions, with course descriptions and transcripts, as well as departmental recommendation. Final course marks of B or better are required, such courses may not have been applied toward any prior degree, the courses must have been completed at an institution accredited by one of the six regional accrediting associations, and those courses must have been completed within four years of the first enrollment in the Lehigh master's program.

Students pursuing a second Lehigh master's degree can apply a limited number of credits to both the first and second masters degrees. Individual program requirements limit the level to which this can be done, but in all cases the credits counted toward any single masters degree cannot include more than 50% of credits that are also utilized to satisfy a second masters degree.

A student must complete the form, "Program for Master's Degree," setting forth the courses proposed to satisfy the degree requirements. This form should be approved by the department and then submitted to the Office of the Registrar as soon as possible after 15 credit hours toward the degree have been completed. Approval of the program by the Office of the Registrar signifies that the student has formally been admitted to candidacy for the master's degree.

THESIS AND COMPREHENSIVE EXAM

Candidates in some programs may be required to submit a thesis or a report based on a research course of at least three credit hours, or to pass a comprehensive examination given by the major department. The department will specify which of these requirements apply and may require both. If required, the thesis or report shall not count for more than six credit hours, and thesis registration is limited to a maximum of six credit hours. If the thesis or research project involves human subjects, the student must complete the university human subjects review packet and receive written approval from the Institutional Review Board. All approved thesis/dissertations copies must be submitted by the appropriate deadlines in electronic form by following the procedures and guidelines found on the LTS Web site URL: http://libraryguides.lehigh.edu/etd (http://libraryguides.lehigh.edu/etd/). Please contact your college dean's office for further clarification.

A non-thesis option exists for certain programs in the Colleges. Students should check with their departments regarding that option.

PROGRAM FOR THE DOCTORAL DEGREE

A candidate for the doctor of philosophy degree ordinarily is expected to devote at least three academic years to graduate work. In no case is the degree awarded to someone who has completed fewer than two full academic years of graduate work. All post-baccalaureate work toward the doctorate must be completed within ten years. A student beginning doctoral coursework after an elapsed period of at least one semester after the master's degree has been conferred is granted seven years in which to complete the doctoral program.

Doctoral students whose graduate study is carried out entirely at Lehigh University must register for a minimum of 72 credits beyond the bachelor's degree. Students who have earned a master's degree at another university must register for a minimum of 48 credits. These requirements include registration for research or dissertation credits. Students participating in approved dual-degree doctoral programs involving external institutions may transfer up to 25% of their total required doctoral program research credits to Lehigh for work that was performed at the external partner institution. Approval of such programs is required by the dean of the relevant Lehigh college.

Full-time students working toward the doctorate normally register for a minimum of nine credits each semester. If the minimum degree registration requirement of 72 or 48 credits is attained prior to formal admission to doctoral candidacy, continued registration of at least three credits per semester is necessary. Such registration does not automatically grant full-time student status, however. Full-time student status must be confirmed on the graduate full-time certification form.

Students seeking to receive both a master's degree and a doctoral degree must complete a minimum of 72 graduate credits at Lehigh and must meet all requirements of both degrees.

After admission to doctoral candidacy, a student must maintain candidacy by registering at least two times each calendar year (in each academic semester or in one academic semester and one summer session). After completion of the minimum registration requirement, plus any additional requirements of the student's department or program, students are permitted to register for 'Maintenance of Candidacy' and will be charged a single credit hour of graduate tuition at the appropriate rate for the degree program in which they are enrolled. Full-time status must be certified on the full-time certification form each semester.

CONCENTRATED LEARNING REQUIREMENT

Each doctoral degree candidate must satisfy Lehigh's concentrated learning requirement. This requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. Two semesters of full-time Lehigh graduate study, or 18 credit hours of Lehigh graduate study, either on or off campus, within a fifteen-month period must be completed.

Individual departments may impose additional stipulations. Candidates should check with their advisers to be certain that they have satisfied their concentrated learning requirements.

LANGUAGE REQUIREMENTS

Language requirements for the Ph.D. are the option of, and in the jurisdiction of, the candidate's department. Since proficiency in a language is not a university requirement, each department decides which languages, if any, constitute part of the doctoral program.

QUALIFIERS

Many departments require students who wish to enroll in doctoral programs to pass qualifying examinations. Since these examinations vary among departments, students should ask their advisers or department chairpersons for more detailed information. If a qualifying examination is not used, students should find out how and when eligibility to pursue doctoral studies is determined.

ADMISSION TO CANDIDACY

With the help of an academic adviser, the student names the faculty members of the doctoral committee, a special committee formed to guide the student through the doctoral program. The committee is responsible for assisting the student in formulating a course of study, satisfying specific departmental requirements, submitting a suitable dissertation proposal and for overseeing progress in research, and evaluating the completed dissertation. At least four faculty are appointed to the committee; one must be a member of an outside department. Committee membership must be approved by the university's Graduate and Research Committee or its designee.

A doctoral student should apply for candidacy no later than two years after completion of the master's degree or its equivalent and after passing qualifying examinations, if they are required by the major department. The prospective doctoral candidate must submit to the doctoral committee a written program proposal that includes a discussion of proposed dissertation research. Upon receiving committee approval of the proposal, the candidate submits the proposal, signed by the committee members, to the appropriate dean for action by the Graduate and Research Committee or its designee. The dean will advise the student of the committee's decision.

If the dissertation research involves human subjects, all research procedures and instruments must be approved by Lehigh University's Institutional Review Board (IRB) prior to the involvement of the subjects.

GENERAL EXAMINATIONS

Examinations composed and administered by the members of the student's doctoral committee are designed to test the candidate's proficiency in a particular field of study. These examinations, which may be either written or oral, should be passed at least seven months before the degree is to be conferred. If a student fails the general examination, a second examination may be scheduled not earlier than five months after the first. If the results of the second examination are unsatisfactory, no additional examination is scheduled.

DISSERTATION AND DEFENSE

The doctoral candidate is required to write a dissertation prepared under the direction of a Lehigh University professor. The dissertation must address a topic related to the candidate's specialty in the major subject, show the results of original research, provide evidence of high scholarship, and make a significant contribution to knowledge in the field.

Upon approval of the advising professor and, if required by the department, secondary readers, the final draft of the dissertation is submitted to the appropriate dean (or designee) for inspection by the date posted in the academic calendar. Upon its return, the student should distribute copies of the draft to the members of the doctoral committee for review and for suggestions for revision. The candidate then schedules a dissertation defense before the doctoral committee, additional faculty members the department may add to the examining committee, and the general public. After the dissertation has been defended and revised accordingly, the student must submit the finished dissertation to the appropriate dean for review by the university's Graduate and Research Committee (or its designee) no later than the date specified in the academic calendar for completion of all degree requirements. All approved dissertations must be submitted by the appropriate deadlines in electronic form by following the procedures and guidelines found on the LTS Web site URL: http://libraryguides.lehigh.edu/etd (http://libraryguides.lehigh.edu/etd/). Please contact your college dean's office for further clarification. Guidelines stipulating the standard form of the dissertation are available in the dean's office.

Graduate Studies Organizations

THE GRADUATE AND RESEARCH COMMITTEE

The Graduate and Research Committee consists of twelve members representing the faculties of Lehigh's colleges: four from the College of Arts and Sciences; two from the College of Business; four from the P.C. Rossin College of Engineering and Applied Science; and two from the College of Education; plus the college deans, the registrar, the vice provost for research, the director of the office of research, two non-voting graduate student members, and a member of the student senate.

The committee formulates policies and regulations on graduate education and it recommends policies and procedures for research-related activities. The committee interprets and applies faculty rules governing graduate students and degrees, including questions concerning student petitions and appeals.

GRADUATE STUDENT SENATE

The Graduate Student Senate is comprised of graduate student representatives from each academic unit. The general assembly meets bi-monthly during the academic year. This body represents the graduate student community regarding graduate programs and graduate student life at Lehigh. Graduate students selected by the Graduate Student Senate are non-voting members of the Graduate and Research Committee and other university committees.

The Senate provides a forum for discussion with university officials and committees, advocates for policy change, disseminates information, and plans social events in order to facilitate communication and community building among graduate students.

Research Centers and Institutes

Lehigh has developed a number of centers and institutes to provide greater research and academic opportunities for students and faculty. Centers and institutes are generally interdisciplinary and complement the scholarly activities of academic departments and represent

scholarship and research based on the expertise and capabilities of a group of faculty members. Frequently, centers relate to the broad-based research needs of government, industry, and the social community.

RESEARCH ORGANIZATIONS/ DIRECTORS AND STAFF

Directors and staff members of the university's research centers and institutes are listed. Complete degree information may be found in the faculty and staff alphabetical listings. In some cases, areas of research interest are given.

All addresses are Bethlehem, Pa. 18015, and the area code is (610).

Advanced Technology For Large Structural Systems (ATLSS) Research Center

117 ATLSS Drive, Imbt Laboratories, Mountain Campus 610-758-3525; Fax 758-5902; www.atlss.lehigh.edu (http://www.atlss.lehigh.edu)

Administration: Richard Sause, Ph.D., ATLSS Director, Manager Infrastructure Monitoring Program; James M. Ricles, Ph.D., ATLSS Deputy Director; Joseph Saunders, Ph.D., Associate Director of Operations; Ian Hodgson, P.E., Manager Industrial Testing Program; Thomas M. Marullo, M.S., Manager Information Technology Systems; Sandy Nemeth, Financial Manager; Leila Mazarul, Coordinator; Richard Sause, Ph.D., Co-Director Pennsylvania Infrastructure Technology Alliance (PITA); James M. Ricles, Ph.D., Director Real-Time Multi-Directional Testing Facility (RTMD)

Faculty Associates: Helen M. Chan, Ph.D., Materials Science & Engineering; John N. DuPont, Ph.D., Materials Science & Engineering; Dan Frangopol, Ph.D., Structural Engineering; Joachim L. Grenestedt, Ph.D., Mechanical Engineering & Mechanics; Wojciech Z. Misiolek, Ph.D., Materials Science & Engineering; Clay J. Naito, Ph.D., Structural Engineering; Herman F. Nied, Ph.D., Mechanical Engineering & Mechanics; Sibel Pamukcu, Ph.D., Civil & Environmental Engineering; Raymond A. Pearson, Ph.D., Materials Science & Engineering; Stephen P. Pessiki, Ph.D., Structural Engineering; James M. Ricles, Ph.D., Structural Engineering; Richard Sause, Ph.D., Structural Engineering; Shamim Pakzad, Ph.D., Structural Engineering; Muhannad T. Suleiman, Ph.D., Geotechnical Engineering; Paolo Bocchini, Ph.D., Structural Engineering; Spencer Quiel, Ph.D., Structural Engineering, Claudia Reis, Ph.D., Structural Engineering

Faculty Emeritus Associates: John W. Fisher, Ph.D., emeritus, Structural Engineering

Research/Staff Associates: Ian C. Hodgson, M.S., Infrastructure Monitoring/Structural Testing; Thomas M. Marullo, M.S., Software Development/System Administration – RTMD, Liang Cao, Ph.D., Research Scientist

The ATLSS Engineering Research Center is a national center for research and education on structures and materials of the infrastructure. Established in May 1986 with a grant from the National Science Foundation (NSF), the Center now addresses the research goals of the NSF, the U.S. Department of Transportation, the Commonwealth of Pennsylvania, the U. S. Department of Defense, and numerous national, state, and local industry and government organizations and agencies. Approximately 80 people, including graduate and undergraduate students, research associates, faculty and staff members representing the disciplines important to large structural systems are active at the Center.

ATLSS research areas include: Advanced Structural Systems and Materials; Measurement, Simulation, and Evaluation of Structural Systems; Infrastructure Reliability, Maintenance, and Life-Cycle Performance; Intelligent Structural Systems; and Infrastructure Hazard Mitigation with particular emphasis on Earthquake-Resistant Structures. The research is conducted in close association with engineers and scientists from several Lehigh departments, industry, government, design and professional groups and other universities.

ATLSS has excellent research facilities and equipment, including two world-class structural testing facilities; the Fritz Engineering Laboratory and the ATLSS Multi- Directional Testing Laboratory, in which researchers study large-scale structural subassemblies under static, dynamic, and/or cyclic multidirectional loading with complete computer-controlled experimentation. A recent grant from the NSF created the real-time multi-directional (RTMD) experimental facility to evaluate the performance of engineering designs and materials during earthquakes, hurricanes and other storms, tsunamis, landslides, and other disasters as part of NSF's Natural Hazards Engineering Research Infrastructure (NHERI) program. ATLSS also has outstanding resources for computing, mechanical testing, welding, metallography, and non-destructive evaluation.

RESEARCH ACTIVITIES

Advanced Structural Systems and Materials

Research is conducted on new structural forms and structural systems to promote efficiency through innovation and to promote the competitive use of high-performance steel, concrete, fiber-composites, and mixed systems for bridge, building, and ship-hull applications.

Measurement, Simulation, and Evaluation of Structural Systems

Techniques for measuring and simulating the behavior of structural systems under realistic loading conditions are being developed and implemented in the laboratory and in the field. Lab and field assessments are made on bridge, highway, railway and ship structures for evaluating their behavior under load, and evaluating the effects of corrosion, fatigue, and other damage.

Infrastructure Reliability, Maintenance, and Life-Cycle Performance

Research is conducted on optimal design, maintenance, monitoring and management of infrastructure systems, and on structural health monitoring, structural damage models and assessment, and predicting the remaining life of structures considering uncertainty.

Infrastructure Hazard Mitigation

Research is conducted on engineering processes and structural systems and materials technology to predict and reduce economic losses and injuries from hazard events, such as earthquake, blast, fire, and vehicular impact.

Intelligent Infrastructure Systems

Research is conducted on materials, components, and systems for sensing, processing and utilizing sensor information, and adaptively controlling the behavior of the large-scale structures of the infrastructure.

Educational Opportunities

The ATLSS Engineering Research Center facilitates broad programs of study and research in the fields of structures and materials. Graduate students in the Center's programs receive master of science, master of engineering, or doctor of philosophy degrees, usually in structural engineering, materials science and engineering, or mechanical engineering. Financial support for graduate students is available through ATLSS by means of fellowships and research assistantships related to sponsored research programs.

Undergraduates participate in the Center's research through summer internships and academic-year special projects.

For more information, write to Dr. Richard Sause, Director, rsause@lehigh.edu or Dr. Joseph Saunders, Associate Director of Operations, jms815@lehigh.edu (chk205@lehigh.edu); ATLSS Engineering Research Center, Lehigh University, 117 ATLSS Drive, Bethlehem, PA 18015-4728; web-site address www.atlss.lehigh.edu (http://www.atlss.lehigh.edu).

Baker Institute for Entrepreneurship, Creativity and Innovation

Whitaker Lab 318, 5 East Packer Ave, Bethlehem, PA 18015, (610) 758-5626 www.lehigh.edu/entrepreneurship (http://www.lehigh.edu/entrepreneurship/)

Lisa Getzler, Executive Director

The Baker Institute for Entrepreneurship, Creativity and Innovation actively fosters and champions the entrepreneurial culture at Lehigh to advance creativity and innovation for economic, cultural and social development. The Baker Institute is designed to create a culture of entrepreneurship across the university, promote innovative thinking

and the realization of entrepreneurial ideas in any field. To that end, the principal goals of the Institute are to:

- Nurture the creative entrepreneurial mindset and skills—in any discipline—among students, faculty, staff and the community to develop a culture committed and able to bring about transformative change;
- Provide opportunities for Lehigh students of all disciplines, levels, and backgrounds to graduate with the skills, experience and attitudes necessary to move creative ideas and new solutions for social problems successfully into sustainable practice;
- Provide supporting infrastructure that enables and significantly increases the likelihood of practical scaling up of innovative ideas and technologies to implementation and launch of new organizations.

Based squarely on a cross-university approach, the Baker Institute aims to expand the creative pipeline of innovation-related curricular and extra-curricular opportunities for students, faculty and the broader community. The Baker Institute serves as an umbrella organization to support and help coordinate, deepen and improve synergies among the substantial network of entrepreneurship-related programs on campus. By expanding resources for that network, and serving as a visible central portal, the Institute champions, highlights and promotes entrepreneurship opportunities on campus and throughout the community.

Institute operations include:

- Strategic oversight for enhancing internal and external exposure and competitively differentiating Lehigh's overall entrepreneurship activities as a whole greater than its parts;
- Offering immersive experiences to augment curriculum, together with youth and enhanced executive education programs;
- Managing and expanding entrepreneurship-related competitions and clubs;
- Leveraging opportunities for partnerships with government agencies and economic development organizations (national, state and local).

The Baker Institute also supports the entrepreneurship-related activities of academic departments and programs by:

- Funding curricular innovation and materials;
- Modifying existing courses to incorporate entrepreneurial thinking;
- Piloting new courses in disciplines across the entire university;
- Exploring alternative structures for courses and course delivery, such as scheduling outside conventional calendar, short courses, modular courses, and Web delivery;
- Organizing cross-college curricular coordination, synergies, and continuous improvement;
- Championing the development of new models of faculty, staff and student incentives to reward and promote entrepreneurial pursuits across many fields;
- Assisting faculty and student start-ups;
- Fostering mentoring relationships,
- Proof-of-concept and early stage venture funding, and
- Facilitating technology transfer, spin-outs, and other forms of commercial and social venture creation;
- Cost-sharing to attract entrepreneurial faculty, researchers, and visiting entrepreneurs for departments across a wide range of disciplines.

The overall objective of the Institute is to cultivate the ability of our students, faculty, staff, alumni, and community members to develop new ideas that produce innovations and sustainable organizations with economic, technical and social benefit.

Center for Ethics

Website: www.ethicscenter.cas.lehigh.edu **(**https://ethicscenter.cas2.lehigh.edu/**)**

Steering Committee: Alex Nikolsko-Rzhevskyy, Economics; Eric P.S. Baumer, Computer Science and Engineering; Paolo Bocchini, Civil and Environmental Engineering; Dena Davis, Religion Studies; Michael Gill, Psychology; Chad Kautzer, Philosophy; Nitzan Lebovic, History; Naomi Rothman, Management; Lorenzo Servitje, English and Health, Medicine and Society; Lloyd Steffen, University Chaplain and Religion Studies; Monica Miller, Religion.

Emeritus: Robin S. Dillon, PhD (University of Pittsburgh)

The interdisciplinary academic Center for Ethics promotes rigorous inquiry into, probing reflection on, and responsible engagement with the ethical dimensions of life from the personal to the global.

Ethics has to do with issues of action, character, and governing values, with questions about right and wrong, good and evil, worthiness and unworthiness, justice and injustice, with matters of individual and collective responsibility, respect and discrimination, war and peace, and with the norms, habits, and systems that make the persons we are, the lives we live, and the societies in which we live together, better or worse. Ultimately, ethics concerns how we ought to live, individually and collectively. Ethical concepts, issues, questions, norms, and systems can be studied philosophically, psychologically, sociologically, anthropologically, historically, politically; ethical inquiry engages the natural and applied sciences and engineering and addresses concerns in economics and business; ethical questions are explored in religion and literature and through artistic expression.

The Center's organizing perspective is that there is no aspect of human beings, no space in human lives, that does not have ethical dimensions—our intrapersonal lives, our interpersonal relations, as well as the educational, professional, familial, social, cultural, religious, artistic, political, economic, environmental, scientific, and global dimensions of our lives together. The ethics domain thus encompasses all aspects of Lehigh University.

Research and Educational Activities

The Center for Ethics, which serves the entire Lehigh community, has three principal aims:

- Enhance student engagement with ethical issues and ethical decision-making
- Foster research in ethics and ethical issues
- Promote public ethics education

The Center functions in two ways. First, it provides resources to support, coordinate, and expand existing ethics-related educational and research activities and programs at Lehigh, thus highlighting and promoting the wide-range of opportunities to engage with ethical issues across the university and in the wider community.

Second, the Center focuses attention on vital but difficult questions and creates new opportunities for engagement with ethical issues in the following ways:

- Bringing to campus ethics leaders from academia, business, civic organizations, government, through the Peter S. Hagerman '61 Lecture in Ethics series;
- Supporting and enhancing curricular, co-curricular, and research opportunities for undergraduate and graduate students in every discipline to develop and apply intellectual tools that will enable them to identify, understand, and deliberate well about ethical issues;
- Nurturing cutting-edge research and scholarship, especially interdisciplinary work, that addresses both current ethical challenges and enduring moral questions;
- Organizing thought-provoking and penetrating explorations of, and informed and unbiased discussions about, the most important ethical problems of our times;
- Taking a major role in fulfilling Lehigh's responsibility to be a leader in public education about ethical issues and approaches to addressing them, and providing a resource of ethics expertise to the wider community.

The Center for Ethics engages with the connections and challenges of the multiplicity of ethical worldviews on our campus, in our

communities and nation, and globally and cross-culturally. The Center thus serves to

- advance the study and practice of ethics;
- enrich the quality of understanding of, discussions about, and deliberation and decision-making concerning moral questions, issues, and problems;
- assist students to become engaged, ethically sensitive citizens who are well-prepared to grapple with the difficult life-choices and ethical challenges they face at Lehigh and will face after graduation; and
- catalyze ethical leadership.

Center for Digital Marketing Strategy and Analytics (C-DMSA)

Director

Er (Eric) Fang, Ph.D.

Iacocca Chair in the Department of Marketing

Founding Director, Center of Digital Marketing Strategy and Analytics

Office: Rauch Business Center (RBC 383); Email: erf219@lehigh.edu

Dr. Fang's research focuses on digital marketing strategy in data-rich environments and international business (link here (https://business.lehigh.edu/directory/er-eric-fang/)).

Digital Marketing Strategy and Analytics

The Center for Digital Marketing Strategy and Analytics will be updating this page with research and academic program information in the future. If you have questions about the Center, please contact the department of marketing, at: inmarket@lehigh.edu, or (610) 758-4743.

Dr. Fang discussed digital transformation and the new Center with Jack Croft, host of Lehigh's College of Business IlLUminate podcast (https://business.lehigh.edu/news/). Listen to the podcast here (https://business.lehigh.edu/blog/2021/eric-fang-our-digital-transformation/) and subscribe and download Lehigh Business on Apple Podcasts (https://podcasts.apple.com/us/podcast/lehigh-university-business-thought-leadership/id1290369542/) or wherever you get your podcasts. (You can also read the podcast transcript (https://business.lehigh.edu/sites/default/files/2021-01/EricFangDigitalTransformation_TRANSCRIPT.pdf).)

Center for Financial Services (CFS)

Director

Kathleen Weiss Hanley

Bolton-Perella Chair in Finance

Executive Treasurer and Secretary at the American Finance Association (https://afajof.org/)

Co-Director, FinTech Minor (https://cbe.lehigh.edu/academics/undergraduate/fintech-minor/)

Executive Director, Financial Economists Roundtable (https://www.financialeconomistsroundtable.com/)

Assistant Director

Meg Foley Wolf '02, '03

Overview

As an academic center in Lehigh University's College of Business, the Center for Financial Services (CFS) (https://business.lehigh.edu/centers/center-financial-services/) provides opportunities to collaborate on real-world, relevant business issues. Since 2016, through conferences, symposia, panels, lectures, and networking events, the CFS aims to bring the latest developments in research and practice together. The CFS is defined by its mission to bridge theory and practice and to promote a meaningful exchange of ideas on critical issues affecting the financial services.

Goals of the CFS:
Provide thought leadership in the field of financial services
Develop innovative ideas and possible solutions to challenges facing the financial services industry
Facilitate open discussions on finance topics among academic scholars, practitioners, policy makers, alumni, and students
Produce and distribute research insights of use and relevance to the industry, whether through Lehigh's excellent faculty scholarship, the Financial Services Lab, or the CFS Blockchain Lab that is part of a broad interdisciplinary initiative across Lehigh in blockchain technology and applications.

Faculty Expertise

The Perella Department of Finance faculty are actively engaged in intellectual discovery and regularly publish in leading finance journals including *the Journal of Finance*, *Journal of Financial Economics*, *Journal of Accounting and Economics*, *Review of Financial Studies*, *Journal of Financial and Quantitative Analysis*, and *Journal of Accounting Research*. Their work has been widely cited and incorporated into both finance curricula and the practice of industry professionals.

Undergraduate and Graduate Program Information

The Center oversees the Financial Services Laboratory (FSL) which serves as the vehicle for understanding, creating, and employing financial data and software on the Lehigh University campus.

The CFS Blockchain Lab promotes interdisciplinary research on the potential uses of blockchain technology in financial services. The lab is designed to engage faculty and students in producing research, conferences, and white papers on the applications of blockchain in areas of finance such as currency, clearing and settlement, capital formation, and efficient contracts. The lab's work addresses the implementation and regulatory challenges in adopting blockchain technology and the challenges and opportunities presented by central-bank digital currencies. The lab is part of a broad, interdisciplinary initiative in blockchain technology and applications (https://blockchain.cse.lehigh.edu/).

CFS Faculty Fellows (https://business.lehigh.edu/centers/center-financial-services/faculty-fellows/) oversee affiliate programs, such as the FinTech Minor, Investment Management Group, which includes the student-run investment funds - Dreyfus Portfolio and Thompson International Portfolio, and the CFS Student Fellows Program. These affiliate programs support the CFS mission.

Collaboration – Universities and Industry

The Annual Conference on Financial Market Regulation (CFMR) (https://business.lehigh.edu/centers/center-financial-services/news-and-events/annual-conference-financial-market-regulation/) accepted its first paper submissions in 2013 and the first conference was held in the spring of 2014, co-hosted by the Securities and Exchange Commission's Division of Economic and Risk Analysis (DERA), the University of Maryland's Center for Financial Policy, and Lehigh's Center for Financial Services. During its ten-year history, the conference has grown in global stature and selectivity, with a current paper acceptance rate of 3%. During the last decade, 98 papers have been presented and discussed, and 40% of them went on to be published in prominent journals such as the *Review of Finance, Management Science, Journal of Accounting Research, Journal of Financial Economics, The Review of Financial Studies, The Review of Asset Pricing Studies, American Economic Review, Journal of Finance, Journal of Accounting and Economics, Journal of Financial and Quantitative Analysis, The Economist,* and *The Quarterly Journal of Economics*, among others. Over 100 institutions from over 18 different countries have presented their papers at the conference.

Held since 2017, the Annual CFS Symposium (https://business.lehigh.edu/centers/center-financial-services/events/symposium/) has featured panelists who discussed a host of timely financial topics. Panelists have discussed the finer points of financial service reform; asset management challenges; blockchain technologies; environmental, social, and governance investing; special-purpose acquisition companies; climate change mandates; investing in collectibles; and most recently the transformative potential of AI in wealth management.

Past speakers are noted experts and hail from a range of well-known organizations and institutions including Sotheby's, MIT, CNBC, Bank of America, Merrill Lynch, Neuberger Berman, BlackRock, Snowflake, and IBM. CFS leverages Lehigh faculty and alumni as

well as industry participants, academics, and regulators to unite research and practice. The annual symposium receives excellent feedback from participants.

The Center also closely collaborates with the Lehigh Wall Street Council (https://alumni.lehigh.edu/lehigh-wall-street-council/), a Lehigh alumni professional alliance, whose mission is to educate and assist Lehigh students in their efforts to find career and internship opportunities in the financial world.

CONTACT

Meg Wolf - maff02@lehigh.edu

Children's Environmental Precision Institute (CEPH)

CONTACT

Director: Hyunok Choi, PhD, MPH
Email: hyc (hyc219@lehigh.edu)219@lehigh.edu (edg219@lehigh.edu)
Phone: 610.758.2626
Website: health.lehigh.edu/research-partnerships/childrens-environmental-precision-health-institute (https://health.lehigh.edu/research-partnerships/childrens-environmental-precision-health-institute/)

core Faculty & staff

- Hyunok Choi, PhD, MPH (https://health.lehigh.edu/faculty/choi-hyunok/), Associate Professor and Director, Children's Environmental Precision Health Institute
- Breena Holland, PhD (https://polisci.cas.lehigh.edu/people/breena-holland/), Political Science, Associate Professor, Lehigh University
- Jeremy Mack, MS (https://lts.lehigh.edu/users/jsm4/), Geospatial Data Visualization Specialist, LTS, Lehigh University
- Fathima Wakeel, PhD, MPH (https://health.lehigh.edu/faculty/wakeel-fathima/), Associate Professor and Director of Graduate Programs

Affiliated Faculty

- Karen Beck-Pooley, PhD (https://polisci.cas.lehigh.edu/people/karen-beck-pooley/), Professor of Practice, Political Science, Lehigh University
- Aimin Chen, MD, PhD (https://www.dbei.med.upenn.edu/bio/aimin-chen-md-phd%C2%A0/), Professor of Epidemiology, Perelman School of Medicine, University of Pennsylvania
- Lifang He, PhD (https://engineering.lehigh.edu/cse/faculty/11317/), Computer Science & Engineering, Assistant Professor, Lehigh University
- Suk-Mei Ho, PhD (https://ncsdvs.uams.edu/ResearcherDirectory/member/?memberId=178), Vice-Provost for Research and Professor, University of Arkansas
- John Spengler, PhD (https://www.hsph.harvard.edu/john-spengler/), Akira Yamaguchi Professor of Environmental Health and Human Habitation, Harvard T. H. Chan School of Public Health
- Taeho Kim (https://www.lehigh.edu/~tak422/index/), PhD, Assistant Professor, Department of Mathematics, College of Arts and Sciences, Lehigh University
- Dimitrios Vavylonis (https://physics.cas.lehigh.edu/content/dimitrios-vavylonis-7/), PhD, Professor, Department of Physics, Lehigh University
- Muzhe Yang (https://www.lehigh.edu/~muy208/muy208.html), PhD, Professor, Department of Economics, Lehigh University
- Bin Zhang, PhD (https://icahn.mssm.edu/profiles/bin-zhang/), Professor of Genetics and Genomic Sciences and Pharmacological Sciences, Mount Sinai School of Medicine
- Min Zhong, PhD, Bureau of Air Quality, Pennsylvania Department of Environmental Protection
- Ainur Khumar, Doctor of Public Health, Kazakh National Medical University

graduate research Students

- Sankar Debnath (College of Health student) working on an externally sponsored research project
- Yasser Benjilali (College of Engineering) working on an externally sponsored research project
- Giovanni Sanchez (College of Engineering) working on an externally sponsored research project
- Juan Rugeles (College of Engineering) working on an externally sponsored research project
- Zhanara Sabydilla (Kazakh National Medical University)

Mission

Does cancer begin when you are growing in the womb? How do your inherent susceptibility factors (e.g., genome, adductome, and transcriptome) interact with environmental exposures (e.g., airborne toxics) and physical home, indoor, neighborhood, and school conditions to increase your risk of asthma, allergies, and obesity? Are you more susceptible to such diseases if exposed to environmental toxics as a fetus or an infant? The Children's Environmental Precision Health (CEPH) Institute aims to answer these questions. A better understanding will help us detect, intervene, and prevent high-risk infants and toddlers from developing irreversible impairment to reaching their physical and intellectual potential.

Research activities

The CEPH's mission is to improve children's health and well-being through the following research, education, and service activities:

- Early-life origins of obesity-associated asthma sub-species
- Sexual dimorphism in asthma risks
- Environmental justice
- Syndromic surveillance
- Health-oriented data analytics
- Urban Health
- Climate adaptation

funding

CEPH has received funding from the following agencies:

- Pennsylvania Department of Health
- Pennsylvania Department of Environmental Protection / US Environmental Protection Agency (EPA)
- National Science Foundation (ADVANCE Grant)
- American Councils for International Education
- U.S. Department of Health & Human Services (DHHS/NIH)

Educational opportunities

CEPH has three educational missions and goals:

- Train students in environmental health science research: CEPH aims to provide students with opportunities to participate in existing research programs.
- Cultivate confidence: The projects in CEPH are designed to engage students as independent investigators rather than mere observers and apprentices. The students are encouraged to publish and present their findings at national research conferences starting from the first year of engagement.
- Collaborate through team science: Working well within a team of peers represents an essential experience for the students. The students are expected to benefit from mutual mentoring and collective problem-solving as multi-disciplinary team members.

Service

CEPH will engage with community members to develop individual- and community-level strategies to reduce exposure to harmful environmental pollutants and prevent the risks. Student-led community-oriented engagement projects will be created and supervised. Two service goals are as follows:

- Learn from the community members: Focus on better understanding the barriers to prevention and management through deep engagement with the Lehigh Valley community members.

- Deepen the partnership: The CEPH will also organize free information-sharing sessions for Lehigh Valley community families.

Emulsion Polymers Institute

111 Research Drive; 610-758-3602

H. Daniel Ou-Yang, Ph.D., director; Eric S. Daniels, Ph.D.

Originally established in 1975, the Emulsion Polymers Institute (EPI), provides a focus for graduate education and research in polymer colloids. Formation of the institute constituted formal recognition of an activity that had grown steadily since the late 1960s. Recently, the research thrust of the Institute has been broadened to include **engineered particles** . The new focus is rooted in fundamental scientific-based particle design, but guided by identified applications, while still maintaining a core competency in emulsion polymerization. The rapidly broadening applications for particle technologies in fields such as biotechnology (e.g., drug delivery, imaging, assembly of biocompatible scaffolds), nanotechnology (e.g., directed assembly of hierarchically ordered, functional structures), and others demand a concomitant *diversification of the institute to include a broader class of particles*: polymeric, inorganic, hybrid, macroionic, metallic, as well as novel particulate composites designed at the nanoscale that will span all industrially-relevant scales.

The institute has close ties with polymer and surface scientists in the Center for Polymer Science and Engineering (CPSE), Center for Advanced Materials and Nanotechnology (CAMN), and the departments of chemical engineering, chemistry, physics, and materials science and engineering. These ties reflect the interdisciplinary nature of research that is carried out in the Institute.

RESEARCH ACTIVITIES

Fundamental particle research in the institute spans particle synthesis, particle functionalization, and directed assembly of particles into higher order, functional structures. Continuing emulsion polymers research is a blend of theoretical and experimental problems related to the preparation, characterization, and applications of polymer latexes and are aimed at understanding the kinetics, mechanisms, morphology, and the colloidal, surface and bulk of the latexes. Applications of this fundamental technology, resulting from interdisciplinary research among the faculty associated with the institute, stand to align well with the strategic university and college-level nanotechnology, biotechnology, and energy/environment initiatives. Many projects within EPI achieve what has been the largest obstacle to commercialization of nanotechnology: scalable process design of nanoscale functioning materials. Materials fabricated by EPI researchers are designed to function either as nano- or microscale sensors, material modifiers, or to self-assemble into advanced materials that depend on the nanoscale features of its constituents. In addition, engineered particle technologies developed at EPI and other institutions have allowed for the validation of soft condensed matter theories at scales available to experimentalists. In the biotechnology area, research focuses on diagnostic and therapeutic technology to prepare particles that are biocompatible, biologically specific, easily detectable, and responsive to external controls. In the area of energy, work focuses on a variety of different unique particle technologies that may be used in applications such as catalysis and photocatalysts for the hydrogen economy, photovoltaics and solar cells, and membrane separations. In the environmental area, in addition to seeking novel particle technology for contaminant remediation in water, tailor-made colloidal particles with desirable surface properties, should provide model systems for fundamental insight into surface phenomena, relationships between bacterial adhesion to a surface and cellular bioenergetics, and bacterial transport through unsaturated porous media. Similarly, model porous media constructed by engineered particles could benefit research on the sources, fate and transport of bacteria in the environment, new water treatment technologies for developing countries, and alternative water disinfection technologies.

Research support for institute activities is obtained from industrial organizations through their membership in the Emulsion Polymers Industrial Liaison Program as well as government agencies. Hence some considerable effort is made to relate the research results to industrial needs. Consequently, graduates can find excellent opportunities for employment.

EDUCATIONAL OPPORTUNITIES

Graduate students in the Institute undertake dissertation research leading to the master of science or doctor of philosophy degree in existing science and engineering curricula or in the Center for Polymer Science and Engineering. Programs of study are tailored to meet the individual needs of each student and considerable flexibility is permitted in the selection of courses and a research topic. Educational and research opportunities exist for postdoctoral scholars and visiting scientists as well as resident graduate students. In addition, the institute holds a short course each June, “Advances in Emulsion Polymerization and Latex Technology” that typically attracts a number of industrial participants as well as EPI students and is an excellent opportunity to interact with industrial scientists and engineers.

For more information, write to H. Daniel Ou-Yang, Emulsion Polymers Institute, Iacocca Hall, Lehigh University, 111 Research Drive, Bethlehem, PA 18015. Please visit our web site at http://www.lehigh.edu/~inemuls/epi/ for further details.

Energy Research Center

117 ATLSS Drive; 610-758-4090

Carlos E. Romero, Ph.D.; Jonas Baltrusaitis, Ph.D.; Arindam Banerjee, Ph.D.; Rick Blum, Ph.D.; Paolo Bocchini, Ph.D.; Hugo S. Caram, Ph.D.; Panayiotis Diplas, Ph.D.; John N. DuPont, Ph.D.; John T. Fox, Ph.D.; Javad Khazaei, Ph. D.; Shalinee Kishore, Ph. D.; Mayuresh Kothare, Ph.D.; Alberto Lamadrid, Ph.D.; Farrah Moazeni, Ph. D.; Colleen Munion, B.S.; Clay J. Naito, Ph.D.; Sudhakar Neti, Ph.D.; Herman F. Nied, Ph.D.; Alparslan Oztekin, Ph.D.; Frank Pazzaglia, Ph.D.; Stephen Peters, Ph.D.; Spencer E. Quiel, Ph.D.; Eugenio Schuster, Ph.D.; Arup SenGupta, Ph.D.; Ramesh Shankar, Ph.D.; Mark Snyder, Ph.D.; Muhannad T. Suleiman, Ph.D.; Natash Vermaak, Ph.D.; Zheng Yao, M.S.

The mission of the Energy Research Center is to find solutions to national and global energy and energy-related problems by collaborating with federal, state and local agencies, energy businesses, technology developers and suppliers, the research community and academic institutions. The Energy Research Center accomplishes this mission through its continued commitment to innovative research and development, while recognizing the important link between energy and the environment. Originally founded in 1972, the Center brings together faculty and professional staff within Lehigh University to conduct research, foster partnerships between government and industry, provide funding, research and educational opportunities to university graduate and undergraduate students, and promote international research collaboration.

ENERGY RESEARCH

Research within the Center falls into five major categories. Projects of interest include:

Energy Conversion/Power Generation

This research program area has several components. The largest focuses on the equipment and processes used in large fossil-fired electric power plants, with research on methods of improving power plant conversion efficiency, of reducing emissions of carbon dioxide and of other gaseous pollutants, and of reducing the cost of generating electricity. Other projects deal with topics such as capture of carbon dioxide and sequestration industry, and renewable energy, including energy storage and decarbonization of energy-intensive hydrogen research.

Energy-Related Environmental Research

The Center’s environmental research program deals with air pollution, solid waste, and ground water contamination issues resulting from power generation and energy conversion activities; reduction of amounts of fresh water required for energy system and wastewater treatment and reuse.

Energy-Related Materials Research

This focus area considers materials issues in the energy field. Examples include high temperature coatings for boiler tubes, welding processes for new alloys, containment vessels for nuclear waste

materials, component life prediction, and development of catalysts for pollution control.

Basic Energy Sciences

Faculty and students in engineering and science also carry out research to improve our understanding of the basic phenomena that underlie the knowledge base required for developing new and improved energy technologies. This includes cross-cutting types such as computer modeling and process optimization.

Educational Opportunities

The Center's research programs provide opportunities for graduate students interested in working in the energy area. Most of the departments in the College of Engineering and Applied Science, as well as several departments within the College of Arts and Sciences, are active in energy research and offer both masters and doctoral degree programs suitable for studies of energy-related topics.

All degrees are granted by the academic departments and graduate students interested in energy enroll in traditional graduate degree programs in departments of their choice. These students specialize in energy by complementing their programs with a selection of energy-related courses. They pursue their graduate research in energy areas under the supervision of faculty from the Energy Research Center or from other research centers or academic departments.

Financial support for graduate students is available through fellowships and research assistantships.

ADDITIONAL INFORMATION

For more information, write to Dr. Carlos E. Romero, Director, Energy Research Center, Lehigh University, 117 ATLSS Drive, Bethlehem, PA 18015, or e-mail at cerj@lehigh.edu (ekl0@lehigh.edu). Please visit our website at www.lehigh.edu/energy (http://www.lehigh.edu/energy/)

Enterprise Systems Center (ESC)

Address: Enterprise Systems Center, Mohler Laboratory, Second Floor, 200 West Packer Avenue, Bethlehem, PA 18015

Website: http://www.lehigh.edu/~inesc/

Center Director: Dr. Emory W. Zimmers, Jr., Professor of Industrial and Systems Engineering, Lehigh University, and ESC Director (email: ewz0@lehigh.edu)

Managing Director: H. Robert Gustafson, Jr. (email: hrg2@lehigh.edu)(phone: 610-758-5869)

Administration: Mythreyi Sekar (email: mys211@lehigh.edu) (phone: 610-758-4955); Mike MacDougall (email: mim3@lehigh.edu) (phone: 610-758-6464)

The Enterprise Systems Center (ESC) was formally established in 1995. This multidisciplinary center is committed to providing student experiential learning and leadership development primarily through industry projects which provide tangible value in the work products for the client companies. The ESC maintains a network of industry partner relationships to serve as a platform for Industrial and Systems Engineering (ISE) Department course opportunities, summer and co-op projects and leadership activities. Partnership and teaming on projects and programs is important and occurs primarily with the ISE Department as well as other departments, centers, and institutes.

The Center also seeks to advance interdisciplinary research and scholarship relating to systems optimization, analytics, information technology, new process development, and manufacturing. Additional research initiatives focus on discovering new methods for collaboration among academic, industry and government partners through the use of advanced technology. Emphasis is given to innovative systems approaches to problem-solving. The ESC is conveniently housed in Mohler Laboratory on Lehigh's Asa Packer Campus.

The Enterprise Systems Center provides undergraduate and graduate students with the opportunity to work with faculty and industry professionals to solve a variety of real world problems. All ISE Department seniors take the Capstone Project Course which often utilizes ESC company partnerships. The ESC's Graduate Student Project Initiative is focused on providing realistic and technologically challenging experiences as part of the educational process and preparation for full time employment, particularly for ISE Master's degree students. Participation by students from all four colleges on projects utilizing ESC's layered mentoring approach provides students with a level of work experience representative of what they will encounter following graduation. This is often a critical factor in acquiring highly competitive employment positions.

Since its inception, ESC has completed more than 1,300 projects with industry and government partners. Over 4,400 undergraduate and graduate students have benefited from experiential learning and leadership development through involvement with the Enterprise Systems Center.

RESEARCH ACTIVITIES

A central mission of the Enterprise Systems Center is to work in partnership with the Department of Industrial and Systems Engineering in both research and scholarship. The ESC conducts research into the development and implementation of enterprise strategies to improve the effectiveness of organizations. This research involves the utilization of systems thinking, information technology, and leadership approaches that add value to engineering education with eventual implementation in industry.

In its applied research efforts, the Center focuses on operational improvements, enterprise resource optimization, and product development or enhancement.

Operational improvement research with partner companies has included the development of decision support systems, processes for workflow analysis and facility reorganization, analysis of constraints and throughput improvement, evaluating sustainable manufacturing opportunities, agile business practices, utilization of analytics tools and the creation of new solutions for supply chain management.

Work in enterprise resource optimization has included methodologies for business process re-engineering relating to utilization of Generative AI tools, Machine learning, Supply Chain, Data Analytics as well as the analysis and selection of Enterprise Resource Planning (ERP) systems.

Applied research in product development or enhancement has included the use of computer modeling and simulation along with analysis and evaluation of existing products, design for manufacturability and robotic assembly support.

Involvement in these applied research activities with industry partners provides Lehigh students with hands-on learning experiences built on progressive responsibility and contribution to high impact company projects. From these activities, students gain leadership skills and valuable industry experience.

The Center also works to create technology-enabled educational techniques which augment traditional learning models. Coupled with knowledge management technology, these resources help to create integrated learning experiences and digital content to support engineering courses. The ultimate objective is to identify key components of innovative behavior and develop the in-person and online educational methods necessary to provide students with the skill-sets and experiences that will prepare them for leadership roles in society.

Within the ESC is the Learning Collaboratory, an innovative educational environment designed for use in support of both physical and virtual classroom models. For example, it enriches traditional educational techniques by utilizing online lectures, presentations and industry partner interactions originating from their physical facilities. The Collaboratory supports remote learning, development of an entrepreneurial mindset and the application of new technologies to augment traditional in-person educational experiences. When utilized as a combined in-person and remote configuration, the ESC Collaboratory helps to create a highly flexible learning platform.

EDUCATIONAL OPPORTUNITIES

The ESC provides support for Industrial and Systems Engineering courses in the analysis and design of industrial and service sector systems, computer and presentation graphics (CAD), industrial engineering techniques, analytics, experimental projects in industrial engineering, and leadership development. All of these courses

are offered through the ISE Department. The ISE senior capstone project class utilizes ESC facilities, mentors, and online conferencing systems to step beyond the traditional classroom experience in project interactions, presentations and remote learning.

The ESC is continuously developing new programs as part of its Leadership Initiative. ESC has founded and is home to the engineering leadership minor. The leadership development course (ISE 382) was named as one of the top curriculum innovations by the Institute of Industrial and Systems Engineers. On multiple occasions, the Enterprise Systems Center has partnered with the ISE Department and has been recognized by organizations such as INFORMS for effective and innovative preparation of students for operations research practice as well as the strengthening of ties with academia and industry.

Participation in industry partner projects is open to all Lehigh students, both undergraduate and graduate, regardless of academic major, based on an interview process and specific project needs. On an ongoing basis, project opportunities for graduate and undergraduate students are often occurring.

For more information, contact Mythreyi Sekar (mys211@lehigh.edu), H. Robert Gustafson, Jr. (email: hrg2@lehigh.edu), or Dr. Emory W. Zimmers, Jr., Professor of Industrial and Systems Engineering, Lehigh University, and Director, Enterprise Systems Center, Mohler Lab, Second Floor, 200 West Packer Avenue, Bethlehem, PA 18015 (ewz0@lehigh.edu) or visit our website http://www.lehigh.edu/~inesc/

Global Islamic Studies, Center for

Program Director: Robert Rozehnal, PhD (Duke) **(**https://religion.cas.lehigh.edu/content/dr-robert-rozehnal/**)**

Email: incasres@lehigh.edu **(**ror2@lehigh.edu**)** **| Phone: 610-758-4280**

Website: http://cgis.cas.lehigh.edu **(**http://cgis.cas2.lehigh.edu/**)**

Supported by the Office of Research & Graduate Programs
Maginnes Hall, Suite 490, 9 West Packer Avenue

Steering Committee

Khurram Hussain, PhD (Department of Religion Studies); Allison Mickel, PhD (Department of Sociology and Anthropology); Ugur Pece, PhD (Department of History); Jessica Peng, PhD (Department of Sociology and Anthropology); Robert Rozehnal, PhD (Department of Religion Studies); and Bruce Whitehouse, PhD (Department of Sociology and Anthropology)

The Center for Global Islamic Studies (CGIS) is an intellectual community committed to the interdisciplinary study of Islamic civilization. The Center was established at Lehigh in 2009 with the generous support of a five-year grant from the Andrew W. Mellon Foundation. Cutting across numerous academic disciplines and departments, CGIS supports the academic exploration of the diverse cultures and rich historical legacy of the Muslim world - from its roots in Abrahamic prophecy and Greek philosophy, to its long interaction with the West and profound impact on global culture, trade, art and architecture, literature, politics, philosophy, science and religious life, from Morocco to Malaysia to Bethlehem, Pennsylvania.

CGIS promotes teaching and research designed to take Islamic Studies into and beyond the classroom by offering students, faculty, and the broader community a variety of forums for dialogue, debate, and experiential learning. The Center's intellectual core is distinguished by three distinct signatures:

- a comparative, interdisciplinary approach to Islamic studies that goes beyond narrow geographic areas and political issues to explore the broader landscape of Islamic civilization, both past and present
- annual programs and events that provide Lehigh students with multiple outlets to encounter the diversity and dynamism of global Islam
- the translation of theory into practice, linking rigorous scholarship on the Muslim world to direct, practical, hands-on learning beyond the boundaries of the Lehigh campus

RESEARCH ACTIVITIES

CGIS spotlights and promotes research and scholarship in interdisciplinary, comparative Islamic Studies. The Center sponsors an annual lecture series with visiting scholars, and an array of campus events (musical performances, workshops, and conferences). A 2016 international conference on Islam in Southeast Asia hosted by CGIS led to the publication of an edited volume: Piety, Politics and Everyday Ethics in Southeast Asian Islam: Beautiful Behavior (London: Bloomsbury Publishing, 2019). The Center organized another conference in April 2022, culminating in a second edited volume entitled, Cyber Muslims: Mapping Islamic Digital Media in the Internet Age (London: Bloomsbury Publishing, 2022).

EDUCATIONAL OPPORTUNITIES

The launch of the Center for Global Islamic Studies marked a pivotal moment in the continued expansion of the educational experience at Lehigh University. Drawing on the university's experience in building interdisciplinary programs, its institutional commitment to international education, and its substantive relationships with numerous Muslim partners, both in the Lehigh Valley and internationally, the Center for Global Islamic Studies plays a central role in the university's mission to provide Lehigh's students with transformative learning experiences that cross academic disciplines and broaden horizons on today's globalized world.

Goodman Center for Real Estate

Director: S. McKay Price
Assistant Director: Shannon Smith

The Goodman Center for Real Estate was established in 1988 through a major gift from Murray H. Goodman, '48. The center is a self-supporting, interdisciplinary unit of the College of Business. The center promotes real estate studies in a variety of ways including scholarly research, engagement with practitioners in the real estate field, and coursework in real estate and real estate finance.

Research Activity

Knowledge generation and dissemination are at the heart of what we do. While this takes many forms, faculty scholars are actively engaged in intellectual discovery and regularly publish in the top academic real estate journals. Their work has been widely cited and incorporated into both real estate curricula and the practice of industry professionals. Additionally, real estate faculty frequently conduct peer-reviews of other scholars' work as well as serve on editorial boards and in academic real estate societies. Not only does this contribute to the real estate discipline broadly, but it solidifies the academic reputation of the Goodman Center and ensures the faculty are on the cutting edge of the field.

The center also supports interdisciplinary faculty, graduate, and undergraduate students with research interests in real estate. Funding possibilities include research grants, data acquisition, travel, and administrative support.

Industry Outreach & Interaction

The center supports a continuing series of seminars and presentations (https://cbe.lehigh.edu/centers/goodman-center-for-real-estate/events/) by academics, real estate executives, and a wide array of industry practitioners. The center also sponsors property/site tours and networking events. Moreover, Lehigh's proximity to major real estate markets enables the center to engage the practitioner community in a variety of joint projects. For example: Sponsored research projects; Continuing education programs and short courses; and, Special conferences and events of national and/or regional interest.

Educational Opportunities

The center serves as the administrative home of the real estate minor (https://cbe.lehigh.edu/academics/undergraduate/degree-programs/real-estate-minor/). The program is open to undergraduate students from all majors and colleges. Additionally, graduate students may take real estate course offerings at the 300-level or higher. All classes are part of an innovative curriculum with hands-on experiences that enable students to expand their knowledge and prepare for real estate careers. Coursework provides ample opportunity for students to engage with both academic faculty and industry practitioners as they dig into case studies, leading industry modeling applications, and other "real world" projects. Our large and growing alumni base of highly accomplished real estate professionals, parents, and friends of Lehigh enthusiastically serve as role models, sounding boards, and mentors to our students.

Contact

Shannon Smith
goodmancenter@lehigh.edu

Humanities Center

Director: Khurram Hussain, Ph.D. (Yale University)

Email: i **(**inhum@lehigh.edu**)**ncasgrd@lehigh.edu **(**http://catalog.lehigh.edu/graduatestudyandresearch/researchcentersandinstitutes/humanitiescenter/incasgrd@lehigh.edu**) | Phone: 610-758-4280**

Website: http://humanitiesctr.cas.lehigh.edu/ (http://humanitiesctr.cas2.lehigh.edu/)

Supported by the Office of Research and Graduate Studies, 610-758-4280
Maginnes Hall, Suite 490, 9 West Packer Avenue

Committee:

Thomas Chen, Modern Languages and Literatures; Suzanne M. Edwards, English; Mary Foltz, English; Eugene Han, Art, Architecture, and Design; Khurram Hussain, Religion; Melpomene Katakalos, Theatre; Chad Kautzer, Philosophy; Olivia Landry, Modern Languages and Literatures; Lee Tong Soon, Music; Monica Miller, Religion; Lindsey Reuben Muñoz , Modern Languages and Literatures; Ugur Pece, History; Annabella Pitkin, Religion; Lorenzo Servitje, English; Amardeep Singh, English; María Bárbara Zepeda Cortés, History

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The humanities consider how we understand and record human experiences. Encompassing a wide range of disciplines including philosophy, history, literature, religion, visual arts, music, and language, humanistic study teaches us how to think creatively and critically about our own identities and our connections to others—whether they live across the street or across the world, whether they lived long ago or will live in the futures we imagine. The Humanities Center at Lehigh University is thus vital for building community both on and beyond our campus. The Humanities Center creates interdisciplinary intellectual opportunities for students, faculty, and staff engaged in humanistic inquiry across departments and programs. Through talks, reading groups, conferences, research grants, and informal gatherings, the Humanities Center fosters a broad community rooted in vibrant, rigorous, and creative inquiry into what it means and has meant to be human.

RESEARCH ACTIVITIES

Supporting scholarly research is at the core of the Humanities Center mission. In the past, faculty, graduate students, and undergraduates have applied for funding to support reading groups, colloquia, conferences and visiting speakers. Graduate students have also received modest financial support to enable them to travel to present research at academic conferences. Summer, Individual and Collaborative Research Grants have also been available for faculty and graduate students. The objective of these grants has been twofold:

1. to strengthen the intellectual community of Lehigh's scholars in the Humanities and
2. to provide support for faculty to pursue a humanistic research project or creative activity and for graduate students to finish their dissertations.

In the future we plan to add research seminars and workshops designed by eligible faculty to support their own research and conferences that lead to publication to the Humanities Center's research portfolio. We believe that these kinds of events will give our faculty and graduate students opportunities to buttress their publications and to interact with well-known scholars who could both help their work and raise their profiles in the field. Improving our research footprint and our profile across academia should enhance our ability to secure grants from sources in and outside the university, and both national and international institutions. The Humanities Center intends to be at the cutting edge of this mission.

Institute for Cyber Physical Infrastructure and Energy (I-CPIE)

Website: icpie.lehigh.edu (https://icpie.lehigh.edu)

Email: incpie@lehigh.edu
Phone: 610-758-6535

Location: Packard Lab, Room 506, (19 Memorial Drive W, Bethlehem, PA 18015)

Directors:

Shalinee Kishore (Electrical and Computer Engineering)

Alberto Lamadrid (Economics)

Carlos Romero (Energy Research Center)

Overview:

The Institute for Cyber Physical Infrastructure and Energy (I-CPIE) at Lehigh is developing and promoting a community of successful

interdisciplinary research teams working in the area of cyber physical infrastructure and energy (CPIE) systems, which are the interdependent and increasingly adaptive systems that underpin all aspects of our society and economy. I-CPIE creates a broad and interdisciplinary research community; engages with industry, government, and academic partners; catalyzes, grows, and supports successful interdisciplinary research teams; and attracts outstanding faculty and students. This results in new knowledge and solutions to critical challenges related to CPIE systems. CPIE systems are interdependent and provide communities with shelter, water, food, medicine, communications and internet, electric power, and fuel. I-CPIE faculty have demonstrated capability to form successful interdisciplinary teams that combine cyber systems modeling and design with physical systems modeling and design. These teams leverage recognized interdisciplinary strengths in: Large Structural Systems, Smart Grids, Cybersecurity, Resilient Infrastructure Systems, Data and Computation, Optimization and Decision Making, Mobile Sensing and Sensor Networking, Energy Efficiency, Natural Hazards Mitigation, Renewable Energy Systems, Fossil Fuel Energy Systems, Energy Efficient Materials and Devices, Water and Energy, and Environmental Science, Technology, and Policy.

Institute for Data, Intelligent Systems, and Computation (I-DISC)

Website: idisc.lehigh.edu (http://idisc.lehigh.edu/)

Email: idisc@lehigh.edu

Phone: 610-758- 4794

Location: Bldg C, Rm 229, (113 Research Drive, Bethlehem, PA 18015)

Directors:

Kate Arrington, Director (Psychology)

Mooi Choo Chuah, Associate Director (Computer Science & Engineering)

Parv Venkitasubramaniam, Associate Director (Electrical & Computer Engineering)

Overview:

The Institute for Data, Intelligent Systems, and Computation (I-DISC) aims to foster research at Lehigh related to data, intelligent systems, and computation. I-DISC is a hub to catalyze, support, and promote interdisciplinary and collaborative research. It brings together scholars from across Lehigh University with an interest in computationally-focused research. Interdisciplinary research teams build on expertise in fundamental computational approaches, such as machine learning, optimization, data science, and system architecture, and explore applied areas such as robotics, computer vision, human-computer interface, finance, privacy and security, cyber-physical systems, energy, and materials science. I-DISC's primary objective is to advance Lehigh as a beacon of interdisciplinary scholarly excellence and make a greater impact in the related fields. The institute also creates a fertile space for collaboration with industrial, academic, and governmental partners to attack some of the most pressing problems in technology and society.

Institute for Functional Materials and Devices (I-FMD)

Website: https://ifmd.lehigh.edu/

Phone: 610-758-1112

Location: 120 Sinclair Lab (7 Asa Drive, Bethlehem, PA 18015)

Directors:

Himanshu Jain, Director

Steve McIntosh, Associate Director

Overview:

The Institute for Functional Materials & Devices (I-FMD) (https://ifmd.lehigh.edu/) pursues innovative new materials and devices that underpin many of society's greatest challenges, from detecting and treating disease, to implementing large-scale renewable energy sources, to securing food and fresh water for all. I-FMD brings together Lehigh's interdisciplinary expertise in the synthesis, fabrication, processing, and materials characterization as applied to sensors, actuators, and other devices that have critical functionality across mechanical, electronic, photonic, and chemical domains.

In addition to promoting interdisciplinary team research and partnerships with industrial and governmental research organizations, I-FMD offers state-of-the-art materials and devices research facilities for use by Lehigh as well as external researchers. These include Materials Characterization Facility (MCF), and Integrated Nanofabrication & Cleanroom Facility (INCF) operated by expert support staff.

Institute of Health Policy and Politics (IHPP)

CONTACT

Director: Eduardo J. Gómez, PhD, MA
Email: edg219@lehigh.edu
Phone: 610.758.3563
Website: health.lehigh.edu/research-partnerships/institute-health-policy-politics (https://health.lehigh.edu/research-partnerships/institute-health-policy-politics/)

Overview

The Institute of Health Policy & Politics (IHPP) is dedicated to conducting research, academic and professional training on political analysis and policy-making processes, while raising awareness about the role of domestic and international health policy-making and the broader political contexts influencing population health.

Professional training will occur among undergraduate and graduate students, postdoctoral fellows, Lehigh University faculty and external organizations. IHPP will also provide historical and real-time, data-driven resources for domestic and foreign healthcare organizations. IHPP aims to support the creation and implementation of more informed, timely, and equitable policies while informing the local community regarding how they can effectively engage with the policy process.

Research

The Institute's mission is to raise awareness about the role of domestic and international health policy-making and the broader political contexts influencing population health:

- Global Health Policy and Politics
- Other related research interests are defined by Affiliated Faculty

Institute for Indigenous Studies

CONTACT

Director: Won S. Choi, *Interim Director*
Email: woc221@lehigh.edu
Phone: 610.758.2839
Physical Address: 524 Brodhead Ave., Bethlehem, PA 18015
Website: health.lehigh.edu/research-partnerships/institute-indigenous-studies (https://health.lehigh.edu/research-partnerships/institute-indigenous-studies/)

Core Faculty and Research Staff

- Justin Begaye (Navajo)
- Carolyn "Carly" Camplain (Comanche)
- Won S. Choi
- Christine M. Daley
- Sean M. Daley
- Ryan Goeckner
- Jason Hale (Prairie Band Potawatomi)
- Charley Lewis (Paiute/Navajo)
- Joseph Pacheco (Quechua/Cherokee)
- Luke Swimmer (Eastern Band Cherokee)

Affiliated Faculty

- Ho'o Hee (K#naka Maoli), Department of Art, Architecture, and Design
- John Hughes, Department of Community and Population Health

- Sara Kangas, Department of Education and Human Services, Special Education Program
- Michelle LeMaster, Department of History
- Patricia Manz, Department of Education and Human Services, School Psychology
- Jessecae Marsh, Department of Psychology
- Tom McAndrew, Department of Community and Population Health
- Holona Ochs (Cherokee Nation), Department of Political Science

Affiliated Graduate Research Assistants

- Abby Bryer, MS student, Population Health
- Katherine Lopez, PhD student, Counseling Psychology
- Laura Porto, PhD student, Community and Population Health
- Maddie Schott, MPH student, Public Health
- Ashlee Simon, PhD candidate, English
- Olivia Wojtowicz, PhD student, Counseling Psychology

Delaware Nation Tribal Historic Preservation Office

- Katelyn Lucas, Tribal Historic Preservation Officer

Mission

The Institute for Indigenous Studies (IIS) partners and collaborates with Indigenous peoples, nations, communities, and organizations to improve Indigenous peoples' physical, mental, emotional, and spiritual well-being throughout the Western Hemisphere. IIS researchers work with Indigenous peoples, nations, communities, and organizations to identify and address the current health and education needs of Indigenous peoples using a multi-level socio-ecological framework and partner with tribal and community organizations, colleges, universities, and other academic institutions to develop culturally appropriate research methodologies and frameworks that can be used to address the health and education needs of Indigenous peoples.

Research Activities

The IIS is actively involved in research and utilizes Community-Based Participatory Research (CBPR), where Indigenous peoples and communities are involved in all stages of our research, from ideas to implementation. Some of our current research includes:

- the prevention and treatment of tobacco addiction
- mental health and addiction
- the health and access to healthcare of Indigenous peoples in jails and prisons
- environment and health
- obesity, weight loss, and diabetes
- maternal-child health
- youth suicide prevention
- infant and child speech and language acquisition
- reservation youth college prep programming
- COVID-19
- contemporary Indigenous identity
- grant writing and research training programs for Native community members
- cultural education programs for non-Native school districts, organizations, and governmental agencies

Funding

The IIS has a long and demonstrated history of funding from federal agencies, national, regional, and local organizations, and tribal communities, as well as from Lehigh University. Our previous and current funders include:

- The American Cancer Society
- The American Lung Association
- The Appalachian Regional Commission (Pennsylvania)
- The Environmental Protection Agency
- The Healthcare Foundation of Greater Kansas City
- The Kansas City Arts Foundation
- The National Cancer Institute
- The National Endowment for the Humanities
- The National Institute for Drug Abuse
- The National Institute on Minority Health and Health Disparities
- The National Science Foundation
- The Notah Begay III Foundation
- The Pennsylvania Department of Community and Economic Development
- The Prairie Band Potawatomi Nation
- The Patient-Centered Outcomes Research Institute
- The Robert Wood Johnson Foundation
- The Shakopee Mdewakanton Sioux Community

Educational Opportunities

The IIS is committed to educating Native and non-Native people about the current state of Indigenous affairs. The IIS accomplishes this through Indigenous-focused undergraduate and graduate courses, independent studies, and internships. We host live and virtual film screenings, panel discussions, presentations, and events focused on Indigenous health, education, and culture. We also assist elementary schools, middle schools, high schools, other colleges and universities, community organizations, and governmental organizations with their Indigenous-focused research and educational programs.

Institute for Interactivist Studies

Interactivism is a philosophical and theoretical approach to modeling multiple biological, mental, and social phenomena. It is attracting interest from scholars and researchers around the world. See https://www.ecointeractivism.com/conference

The primary functions of the Institute for Interactivist Studies are:

1. to build on the growing interest in the model,
2. to promote interactivist research,
3. to give Lehigh greater visibility within this wider community of people involved in the interactivist research program.

The primary focus of the Institute is the sponsoring of Summer Institutes on Interactivism. We have organized eight International Summer Institutes: 2001 at Lehigh; 2003 in Copenhagen; 2005 at Clemson University; 2007 in Paris; 2009 in Vancouver; 2011 in Syros, Greece; 2013 at the University of South Florida in Tampa, FL; 2015 at Bilkent University in Ankara, Turkey; and via Zoom at https://www.ecointeractivism.com/conference. These have attracted philosophers, psychologists, biologists, roboticists, and linguists from more than twenty countries.

The Institute also:

1. sponsors an institute web site — http://www.lehigh.edu/~interact/index.html (http://www.lehigh.edu/~interact/),
2. encourages and sponsors visiting scholars, and
3. encourages collaborative work.

For more information, contact Mark Bickhard, Director, mhb0@lehigh.edu.

Lawrence Henry Gipson Institute for Eighteenth-Century Studies

Director: Michelle LeMaster, Ph.D
Email: mil206@lehigh.edu **| Phone: 610-758-3358**

Website: https://gipson.cas.lehigh.edu/

Supported by the Office of Research and Graduate Studies, 610-758-4280
Maginnes Hall, Suite 490, 9 West Packer Avenue

Gipson Council: Eugene Albulescu, MM (Department of Music), William Bulman, PhD (Department of History); Lyndon Dominique, PhD (Department of English); Scott Paul Gordon, PhD (Department of English); Michael Jorgensen, DMA (Department of Music); Michelle LeMaster, PhD (Department of History); Monica Najar, PhD (Department of History); John Savage, PhD (Department

of History); Maria Bárbara Zepeda-Cortés, PhD (Department of History)

The Lawrence Henry Gipson Institute for Eighteenth-Century Studies was established in 1971, to honor one of America's most distinguished scholars, who served as a long-time member of the faculty at Lehigh. Gipson's monumental life work, *The British Empire Before the American Revolution* (15 volumes) was written between 1936 and 1970. Gipson received the Pulitzer Prize in History in 1962 for Volume 10, subtitled, *The Great War For Empire*. Professor Gipson left a generous bequest to establish the institute, which forms the basis for the current endowment.

RESEARCH ACTIVITIES

The income from the endowment of the institute is used to encourage faculty and student research in the eighteenth century by providing grants to defray travel costs, copying, and other expenses to permit scholars to visit necessary libraries and depositories. Over the years, the institute has also helped provide additional resources to build the university library's research collections in eighteenth-century studies.

EDUCATIONAL OPPORTUNITIES

The institute regularly invites leading scholars to give lectures on research related to eighteenth century topics in a variety of disciplines. The institute maintains a continuing close relationship with Lehigh University Press for publishing original manuscripts on the eighteenth century.

Loewy Institute

Loewy Institute (formerly Institute for Metal Forming) 5 E. Packer Avenue; 758-4252

Wojciech Z. Misiolek Sc.D. director, John Coulter, Ph.D., John DuPont, Ph.D., Scott Gariggan, Ph.D., Christopher Marvel, Ph.D. Laura Moyer, Ph.D., Michael Rex, Brian Slocum, Ganesh Balasubramanian, Ph.D., Natasha Vermaak, Ph.D., Masashi Watanabe Ph.D., Kai Landskron Ph.D., Raymond Pearson Ph.D., Chinedu Ekuma, Ph.D.

The Loewy Institute continues tradition of the Institute for Metal Forming, which was established in 1970 to teach the principles and applications of metal forming technology to graduate and undergraduate students, to provide instructions and equipment for graduate research in metal forming processes, and to assist industry with solutions to problems in metal forming.

The main objective of the institute's research is to conduct cross-disciplinary process engineering studies to better understand and control manufacturing processes and their impact on the microstructural response of a material. The material microstructure developed during processing is responsible for physical properties of the material. Recently, classical metal forming research has been expanded to include projects in powder processing including additive manufacturing, microstructure characterization and analysis, as well as forming and processing technologies for polymers, glasses, and ceramics and nanomaterials.

The study of the forming processes encompasses physical and numerical modeling; simulation of microstructure response to process parameters. Computer enhanced analysis of material flow also allows us to optimize tooling design in many manufacturing processes. The combined quantitative results of these techniques may then be compared with experimental data obtained from instrumented metal forming laboratories (such as those maintained at the institute), or from our research partners in industry.

RESEARCH ACTIVITIES

Current research areas include: deformation and processing of metals, metal and ceramic powders, light-optical and electron-optical micro-texture characterization, tooling design and tooling materials, thermo-mechanical processing of metals, rapid prototyping and rapid tooling aka additive manufacturing, and machinability of the sintered powder materials. Additionally new research projects have been initiated in development of materials for medical and energy applications.

EDUCATIONAL OPPORTUNITIES

Students interested in metal forming should refer to course offerings in the departments of materials science and engineering, mechanical engineering and mechanics, and industrial and manufacturing systems engineering.

For more information contact Wojciech Z. Misiolek, Director, Loewy Institute, 374 Whitaker Laboratory, Lehigh University, 5 East Packer Avenue, Bethlehem, PA 18015

Martindale Center for the Study of Private Enterprise

Main Office: Rauch Business Center, Suite 350 / 621 Taylor Street / 610.758.4771

Current Faculty: Todd A. Watkins, Ph.D., Executive Director, and Director of the Microfinance Program, Stephen H. Cutcliffe, Ph.D.; Alberto Lamadrid, Ph.D.; Catherine Ridings, Ph.D.; Richard N. Weisman, Ph.D.; George P. White, Ph.D.; Andrew Ward, Ph.D.

Faculty Emeriti: J. Richard Aronson, Ph.D., 1937-2023 Deceased, founding Director, Jesus M. Salas, Ph.D., former Associate Director and Director of The Family Business Institute, Judith A. McDonald, Ph.D., former Associate Director and Director of the Canadian Studies Program, Robert J. Thornton, Ph.D., former Associate Director and former Editor of Martindale Publications.

Staff: Trisha S. Alexy, Martindale Program Manager; Melissa M. Gallagher, Administrative Coordinator.

Founded in 1980 thanks to a generous endowment from Elizabeth Fairchild Martindale and Harry Turner Martindale '27, the Martindale Center for the Study of Private Enterprise is an interdisciplinary resource in Lehigh University's College of Business. The Center engages students, faculty, and the business and policy communities in active inquiry tackling questions central to understanding and fostering sustainable private enterprises and inclusive economic systems throughout the world.

Each year since 1980, the Martindale Student Associates Honors Program has enabled a select group of the very best Lehigh juniors and seniors, from disciplines across the entire university, to actively explore global business and economic issues through research travel to organizations around the world, and interviews and meetings with decision makers, distinguished executives, and scholars. Students' original research is published in the Center's academic journal, Perspectives on Business and Economics *(*https://preserve.lehigh.edu/cbe-martindale*/)*. The program is the flagship of the Martindale Center and a hallmark of Lehigh's commitments to student engagement, research excellence, and globalization.

Martindale's Microfinance and Microenterprise Program, launched in 2005, advances understanding of the development and impact of microfinance locally and globally. It comprises a broad range of activities including faculty research, undergraduate and graduate student research, academic-industry initiatives, workshops and conferences, opportunities for field immersion in the US and abroad, and a community lending practicum and internships for students.

The Martindale Center produces a range of scholarly publications and provides sponsorship and support for faculty research, lectures, conferences, and visiting scholar and executive-in-residence programs.

Contact Us: Martindale Center for the Study of Private Enterprise Rauch Business Center, Lehigh University College of Business 621 Taylor Street, Suite 350, Bethlehem, PA 18015 ***** Executive Director: Todd A. Watkins 610-758-4954 / taw4@lehigh.edu ***** Martindale Program Manager: Trisha S. Alexy 610-758-5664 / tsa2@lehigh.edu ***** Administrative Coordinator: Melissa Gallagher 610-758-4771 / mmg314@lehigh.edu ***** Website: https://business.lehigh.edu/centers/martindale-center (https://business.lehigh.edu/centers/martindale-center/)

Philip and Muriel Berman Center for Jewish Studies

Director: Jodi Eichler-Levine **(**https://religion.cas.lehigh.edu/content/dr-jodi-eichler-levine/**), Ph.D. (Columbia University)**

Email: incasres@lehigh.edu **| Phone: 610-758-4280**

Website: https://bermanctr.cas.lehigh.edu/

Supported by the Office of Research and Graduate Studies, 610-758-4280
Maginnes Hall, Suite 490, 9 West Packer Avenue

Steering Committee

Jodi Eichler-Levine, Ph.D.(Department of Religion Studies); Hartley Lachter, Ph.D. (Department of Religion Studies); Nitzan Lebovic, Ph.D. (Department of History); Ben Wright, Ph.D. (Department of Religion Studies)

Emeritus Faculty

Laurence J. Silberstein, Ph.D. (Department of Religion Studies), Lenore E. Chava Weissler, Ph.D. (Department of Religion Studies), and Roslyn Weiss, Ph.D. (Department of Philosophy)

The Philip and Muriel Berman Center for Jewish Studies, established in 1984, develops, administers, and coordinates a comprehensive program in Jewish studies at Lehigh University. The center is directed by Jodi Eichler-Levine , Philip and Muriel Berman Professor of Jewish Civilization.

Several faculty members, including two Philip and Muriel Berman professors, teach Jewish studies classes at Lehigh. In 2007, the Helene and Allen Apter Chair of Holocaust Studies and Ethical Values was created with the generous support of Helene and Allen Apter ‘61 and Lehigh’s College of Arts & Sciences.

Other activities of the center include designing and implementing new courses and seminars for the Jewish studies minor, an annual lecture series, scholarly colloquia held overseas, and academic conferences. The Berman Center also co-sponsors events with other departments and programs at Lehigh and at institutions across the Lehigh Valley. The Center also provides funding to students to help them pursue study abroad experiences or other enhancements to their academic work in the field of Jewish Studies.

Promoting Research to Practice - Schools, Families, Communities (Center for)

L111 Iacocca Hall, 111 Research Drive 610-758-3267

Lee Kern, Ph.D., Director

The mission of the Center for Promoting Research to Practice (CPRP) is to generate new knowledge that will truly impact the lives of individuals with or at risk for disabilities and to enhance the translation of new knowledge into practice. All too often research that is created for these individuals remains at the development level and is not disseminated into best practices. The Center is focused on conducting and disseminating applied research and assuring research outcomes get into the hands of parents and practitioners as quickly as possible.

APPLIED RESEARCH OPPORTUNITIES

The CPRP focuses on applied research that has a significant impact on the lives of individuals who have identified areas of disability or are considered at risk for developing disabilities. Research conducted through the CPRP is supported primarily through federal grants. Projects focus on assessment and intervention in schools.

PARTNERSHIP

The Center forms and maintains partnerships at national, regional, and local levels. Several objectives are established to accomplish this goal. The CPRP assists with the development and implementation of research projects designed in local school districts and intermediate units, as well as early childhood education and intervention providers. Many school districts do not have the capacity to engage in wide scale research efforts. Yet, these districts often have very significant needs for empirically-based decision making. The CPRP provides a cost effective vehicle for these districts to engage in such research efforts. Another level of partnership for the CPRP is interdisciplinary research within the University community. This objective is met through facilitating cross-college and cross-program proposals. Continuous efforts are made to invite colleagues from across departments and colleges in the University to join with faculty in the College of Education in pursuing research interests that are within the mission of the Center. Research also is conducted with colleagues across institutions.

DISSEMINATION

The CPRP is a resource for facilitating the translation of research into practice. Investigators conducting research have published the outcomes of findings in professional journals and outlets. In addition, the CPRP disseminates research findings and state-of-the-art interventions and strategies to parents, teachers, and other practitioners through our website and other dissemination activities.

LEHIGH UNIVERSITY AUTISM SERVICES

Lehigh University Autism Services is a clinic housed in the Center for Promoting Research to Practice. The mission of the clinic is to develop and disseminate research-based practices that improve the well being of children with autism and their families and to serve the local community. The clinic provides intervention programs for young children with autism spectrum disorders (diagnosis to age 5) and their families. http://wordpress.lehigh.edu/cprp/autism-services/

For more information, contact Dr. Lee Kern, Director, Center for Promoting Research to Practice, College of Education, Lehigh University, Iacocca Hall, 111 Research Drive, Bethlehem, PA 18015; 610-758-3267 or email lek6@lehigh.edu; Web site: http://www.lehigh.edu/go/cprp (http://www.lehigh.edu/go/cprp/).

Supply Chain Research (Center for)

Rauch Business Center, 621 Taylor St.

CENTER MISSION

The Lehigh Center for Supply Chain Research (CSCRL) bridges theory and practice to promote a collaborative exchange of ideas on critical issues affecting supply chain management. By leveraging Lehigh’s faculty, students, alumni, and industry partners, the Center brings together the latest developments in research and best practices to generate new ideas for education and future knowledge in the field.

WHAT THE CENTER DOES

- Provides a unique, multidisciplinary approach to research, offering exciting new opportunities for innovation by integrating analytical and quantitative engineering approaches with process-driven and field-based business research.
- Conducts professional development seminars and symposiums, APICS certification courses, and executive round tables.
- Disseminates research findings through professional conferences, scholarly publications, and curriculum development.

AFFILIATED FACULTY

Zach Zacharia, Ph.D., Director; David Peng, Ph.D.; Saif Mir, Ph.D.; Philip Coles; David Rea, Ph.D.; David Zhang, Ph.D.; Haoyan Sun, Ph.D.; Han Ye, Ph.D.; Sun Kim, Ph.D.; Michael Rivera, Ph.D.; Yaqin Sun, Ph.D.

For more information, contact Prof. Zach Zacharia, Director, (zgz208@lehigh.edu), Center for Supply Chain Research, Lehigh University, Rauch Business Center, 621 Taylor Street, Bethlehem, PA 18015; (610-758-5157). Web site:https://cbe.lehigh.edu/centers/lehigh-center-for-supply-chain-research (https://cbe.lehigh.edu/centers/lehigh-center-for-supply-chain-research/)

Other-University Related Centers

BEN FRANKLIN TECHNOLOGY PARTNERS OF NORTHEASTERN PENNSYLVANIA

The Ben Franklin Technology Partners of Northeastern Pennsylvania (BFTP/NEP) is headquartered in Ben Franklin TechVentures® on the Mountaintop campus and is a wholly-owned subsidiary of Lehigh. Serving a 21-county region, the Center is part of a four-member, state-funded economic development program that is an initiative of the PA Department of Community and Economic Development and is funded by The Ben Franklin Technology Development Authority. Ben Franklin frequently utilizes the faculty, students, and resources of Lehigh to accomplish its tasks.

BFTP/NEP fosters innovation to stimulate economic growth. By providing financial investments, expertise, and links to proven resources, Ben Franklin facilitates the creation of new products, sophisticated technologies, and novel processes among entrepreneurs and established companies to help them prosper. The result: the creation and retention of highly paid, sustainable regional jobs; the development of a strong, diversified, and resilient regional ecosystem, and the development and commercialization of goods and services that improve the human condition.

The goals of BFTP/NEP include helping early-stage technology-oriented firms to form and grow, helping established manufacturers to improve productivity through the application of new technologies and practices, and promoting an innovative community-wide infrastructure that fosters a favorable business environment for high-growth companies. Founded in 1983, the Ben Franklin Technology Partners of Northeastern Pennsylvania has:

- Created and retained 76,956 jobs.
- Established 535 new companies.
- Commercialized and developed 2,456 new products and processes.

The Ben Franklin program is structured to help companies achieve sustainable competitive advantage. Statewide, new tax revenue generated because of Ben Franklin represents a 3.9-to-1 payback to the Commonwealth.

Assistance includes expertise, largely contributed in the northeast by the center's association with Lehigh and other leading research universities, and funding, with investments ranging from $30,000 to $150,000 per year for up to three years. Faculty and students involved with Ben Franklin gain experience in solving real issues for working companies. Technical and business assistance services are provided on a year-round basis.

BFTP/NEP owns and operates Ben Franklin TechVentures, an award-winning business incubator and post-incubator facility. Sixty-nine successful companies have graduated from the BFTP/NEP incubator, grossing more than $1.2 billion in annual revenue last year and creating more than 6,900 jobs. Ben Franklin TechVentures is LEED Gold certified.

For more information, contact the Ben Franklin Technology Partners of Northeastern Pennsylvania, Ben Franklin TechVentures®, 116 Research Drive, Bethlehem; 610-758-5200; www.nep.benfranklin.org (http://www.nep.benfranklin.org); E-mail - info@nep.benfranklin.org; Twitter @BenFranklinNEP; Facebook - BenFranklinNEP; LinkedIn - Ben Franklin Technology Partners of Northeastern Pennsylvania; Instagram @BenFranklinNEP.

MANUFACTURERS RESOURCE CENTER (MRC)

Founded in 1988 as a wholly owned subsidiary of Lehigh University, MRC is one of seven statewide Industrial Resource Centers (IRCs) established to help small and mid-size manufacturers grow and remain competitive. In 1994, MRC joined the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) which is comprised of 51 nationwide centers. MRC works with manufacturing companies by leveraging its own staff of experienced Business Development Managers with public and private sector resources. Through our assistance and work with manufacturers, we help raise the economic level of the region by creating high impact, cost-competitive manufacturers.

Due to space restrictions, MRC moved off of Lehigh's Goodman Campus to Allentown, a central location for MRC manufacturing clients. MRC serves all of Lehigh, Northampton, Berks, Carbon and Schuylkill counties and offers services in six broad areas:

- Technology Acceleration Services that include Technology Scouting and Technology Driven Market Intelligence (TDMI), Innovation Engineering, and Product Development.
- Strategic Business Growth Services and top line initiatives that include strategic planning, market opportunity research, focused lead generation, website and brand strategies, marketing/sales coaching, export services and supplier development.
- Operational Excellence services that include Lean, Six Sigma, Quality and Hoshin Deployment programs. We incorporated sustainability and coaching components into our Lean training and now apply a Green lens for greater profitability and cost savings;
- Business Performance Services to help mentor companies in financial analysis and strategies, capital sourcing and management, mergers and acquisitions, establishing visual business intelligence systems, technology and innovation strategies, "Green" and Sustainability transformations, tax credit opportunities, and other related services.
- Leadership Development & Training that includes the Manufacturing Leadership Institute (MLI), individual Culture Assessments, CoreValue® Business Assessments, Customized Leadership Coaching, Human Resource Development and the Image of Manufacturing. Through one-on-one coaching, strategic "doing" management and milestone development, we can help you grow your effectiveness as a leader.
- A strategic mix of **Training and Certification** programs that are beneficial to any manufacturing organization. We connect manufacturers with experienced, proven resources that specialize in Lean manufacturing training, tools, coaching and certification. We also offer our own 13-part **"Lean Master Certification"** program, a "train and do" curriculum that includes everything you need to prepare for and pass the SME Bronze Exam. The course curriculum includes ex-Toyota keynote instructors and other national presenters, as well. The hands-on elements of the program are also adding to the excitement from the classes. Participants get to actually use the tools when they are taught – reinforcing the proper protocol and use in real time. MRC also offers **Six Sigma Training and Certifications**, as well as coaching, mentoring and SPC-based assessments. We also offer **Quality Certifications** that connect manufacturers in need of quality management process solutions with best-in-breed resources. Whether it's ISO, AS, API, HACCP or another quality-related certification, we have the experts and connections to help you gain certification.

For further information or assistance, please contact MRC at 7200A Windsor Drive, Allentown, PA 18106. Richard C. Hobbs is President & CEO and can be reached at (610) 628-4575 or email him at rich.hobbs@mrcpa.org . Please visit our website at www.mrcpa.org (http://www.mrcpa.org).

PHILIP RAUCH CENTER FOR BUSINESS COMMUNICATIONS (THE)

621 Taylor Street; 758-4863

Matthew Gilchrist, PhD, director

The Rauch Center for Business Communication has three strategic goals.

1. Support business students as they develop the rhetorical awareness and skills necessary for successful business communication, including written, oral, and visual communication in varied contexts.

- Collaborates to ensure student success in the Business Communication sequence required for undergraduate majors
- Provides tutoring support for all business students through the Communication Consultants program
- Supports students' communication needs in extra-curricular activities, e.g. the Data Analytics Competition Team

2. Partner with College of Business faculty to design methods that use the transformative power of communication to prepare students for professional success.

- Assists in developing assignments, syllabi, and activities that can enhance students' exposure to and practice with business communication including writing, presentations, and digital modes
- Promotes curricular innovations by providing strategic planning and logistical support for sustainable, high impact communication activities in and beyond the classroom

3. Combine research in emerging practices with insights from business and community leaders to

provide opportunities for innovation and leadership in business communication.

- Develops collaborations outside the University to ensure that practice informs academic approaches to teaching and learning business communication
- Participates in scholarship and professional organizations dedicated to business communication

For more information, write to Elizabeth Gross, Coordinator, The Philip Rauch Center for Business Communication, Lehigh University, 621 Taylor Street, Bethlehem, PA 18015-3117, or email EAG415@lehigh.edu or phone 610-758-4863.

SMALL BUSINESS DEVELOPMENT CENTER

Brett Smith, BA, MBA, Director; Mary Syslo, BS, MHRM, Associate Director; Robert Mineo, BS, MBA, Program Director, Financing Assistance Program; Jasmita Saini, BA, MBA, Program Director; Andrea Hampton,BA, MBA, Program Director; DJ Kormanik, BS, Consultant; and Darryl Wentz, BS, Consultant. (https://sbdc.lehigh.edu/)

Established in 1978, the SBDC provides general management assistance to over 1,000 entrepreneurs and small businesses per year in the Lehigh Valley and surrounding areas. Primary funding for this program comes from major grants from the U.S. Small Business Administration and the Commonwealth of Pennsylvania.

Specialized Programs

The Management Assistance Program delivers general management consulting to existing small firms and startup ventures. Services are offered to retail, service, wholesale, construction and manufacturing firms. Research is offered through electronic data base research. Seminars are offered on many topics of interest to start-up and growing firms.

International Trade Development Program (ITDP)

The International Trade Development Program (ITDP) is a specialized outreach effort of the Small Business Development Center. The ITDP helps companies with exportable products to develop export marketing plans and establish direct contacts with international markets. Seminars, trade missions and research projects support the efforts of this program.

Financing Assistance Program

The Financing Assistance Program provides assistance in loan packaging and financial planning and helps clients identify appropriate financing sources. The program administers the Lehigh Valley Small Business Loan Pool and the Lehigh Valley Chapter of the Northeastern Pennsylvania Angel Network, a partnership program with the Ben Franklin Technology Partners of Northeastern PA. Contracts with the Lehigh/Northampton Revolving Loan Fund, the Lehigh Valley Economic Development Corporation and other funding agencies provide resources for this assistance.

Lehigh Valley Export Network (LEXNET)

The Lehigh Valley Export Network (LEXNET) is the regional office of the Team Pennsylvania Export Network. Throughout the year LEXNET brings PA foreign office representatives to the Lehigh Valley to meet with SBDC clients and discuss in country export assistance needs. LEXNET also assists with export finance programs such as Market Access Grants allowing small and midsized manufacturing or service companies to participate in international trade events. Specialized training events and seminars are also held throughout the year.

Business Education and Training Program (BETP)

The Business Education and Training Program of the Small Business Development Center provides specialized workshops, seminars and customized training for the small business community.

For more information, write to Brett Smith, Director, Small Business Development Center, 416 E 5th Street, Bethlehem, PA 18015

Courses, Programs and Curricula

For more information about specific academic programs and opportunities, see the following pages.

College of Arts & Sciences

Robert A. Flowers, *Dean;* Kelly Austin, *Associate Dean;* R. Michael Burger, *Associate Dean;* Dawn Keetley, *Associate Dean;* Jessecae Marsh, *Associate Dean*

The College of Arts & Sciences is the heart of Lehigh University, offering a wide variety of academic majors, minors, and interdisciplinary programs, while also providing essential liberal arts access to all Lehigh students. College of Arts & Sciences faculty are engaged as active scholars, are highly accessible, and are committed to the teaching mission of our undergraduate programs. A hallmark of our college is the faculty's ability to engage students interactively and experientially in teaching, research, and scholarship.

A College of Arts & Sciences education treats each student as a unique individual whose capacities and knowledge evolve across a lifetime of learning and engagement. Students discover and nurture their potential. They cultivate knowledge, skills, and values that free them to grapple with fundamental intellectual problems, ponder complex issues, and contribute to their communities, both during and after college.

The University motto, which quotes from the 17th-century humanist and scientist Sir Francis Bacon, is homo minister et interpres naturae — "humans, servants and interpreters of nature." Inspired by this aphorism and responsive to its legacy, the College prepares students to engage with both human nature and nature writ large in a spirit of both inquiry and service. Through the liberal arts curriculum, students pursue a multidisciplinary understanding of human experience, artistic and linguistic expression, and the natural and social worlds. Students tackle big questions and contemporary challenges, build critical intellectual skills, and explore diverse disciplinary perspectives and tools. When they leave Lehigh, students are prepared to confront the challenges and opportunities of tomorrow with integrity and responsibility.

The College of Arts & Sciences invites students to explore their interests, feed their curiosity, and discover the knowledge and tools that will enable them to thrive as individuals and citizens of the world.

The College of Arts & Sciences offers several curricular options:

- A four-year College of Arts & Sciences curriculum leading to a bachelor of arts or bachelor of science degree in designated fields;
- Dual degree programs within the college and in conjunction with the other three undergraduate colleges;
- Double BA major program with the College of Health, please see below for more information;
- A five-year Arts-Engineering curriculum leading to a bachelor's degree from the College of Arts & Sciences and a bachelor of science degree from the College of Engineering and Applied Science;
- A five-year program leading to a bachelor's degree from the College of Arts & Sciences and a master's degree in Education (p. 361) from the College of Education. Please see below for more information;
- Additional five-year programs leading to a bachelor's degree from the College of Arts & Sciences and a master's degree through the Colleges of Business (https://catalog.lehigh.edu/coursesprogramsandcurricula/businessandeconomics/), Engineering and Applied Science (https://catalog.lehigh.edu/coursesprogramsandcurricula/engineeringandappliedscience/), and Health (https://catalog.lehigh.edu/coursesprogramsandcurricula/health/).

The College of Arts & Sciences Curriculum Overview

The College of Arts & Sciences curriculum is structured around four broad objectives of a liberal arts education:

- Building Critical Intellectual Skills
- Exploring Diverse Disciplinary Perspectives and Tools
- Tackling Big Questions & Contemporary Challenges from Multidisciplinary Perspectives
- Developing Knowledge & Expertise in a Focused Area of Study

To fulfill these objectives, students pursue broad study across the college curriculum with at least 12 distinct courses, in addition to a focused effort in an individual program of study.

Distribution Requirements

Big Questions Seminar	3-4
First-Year Writing Courses [1]	6
Mathematics Course	3
At least 2 courses and 7 credits in each of the 4 Disciplinary Perspectives:	
Interpreting & Understanding Human Experience (HE)	7
Creating & Expressing through Arts & Languages (AL)	7
Investigating the Natural World (NW), including 1 Lab (LS)	7
Investigating the Social World (SW)	7
3 Encounters in each of the following areas:	
Contemporary Challenges (CC)	
Quantitative Reasoning (Q)	
Writing (W)	

1

FY Writing requirement may be fulfilled through WRT 001 & 002. Students who earn credit for both WRT 001 & 002 through AP or IB scores will take WRT 011: Advanced Writing: The Rhetorical Self, to complete the FY Writing Requirement. Options for multilingual speakers, WRT 003 & 005, are available through appropriate placement with the International Center for Academic & Professional English (ICAPE).

Required Coursework

Big Questions Seminar: Students take one Big Questions Seminar in the first semester. Big Questions Seminars are designated by course number '090' and focus on complex questions that have no simple or obvious answers. These can include, but are not limited to, the deep enduring questions that humanity has grappled with for ages or emerging questions of today. Big questions often transcend disciplinary boundaries. Thus, many Big Questions Seminars illustrate how multiple disciplines or multiple fields within a discipline approach the seminar's focal question, and some are co-taught by faculty from different fields. These seminars are designed to facilitate students' transition to the intellectual environment of a college classroom and to develop students' intellectual and practical skills (e.g., inquiry and analysis, critical and creative thinking, written and oral communication, quantitative reasoning, information literacy, teamwork, problem solving).

First-Year Writing (WRT): Students take two designated courses in their first year that focus on pre-disciplinary writing, including engaging thoughtfully with the writing process, practicing clear academic writing and argument, analyzing and practicing persuasive strategies and critical thinking, and developing information literacy skills. Students who qualify based on AP or IB Exam scores will take an honors path, which consists of one designated advanced first-year writing course. Multilingual learners who qualify based on testing conducted by the International Center for Academic and Professional English take two

courses taught by language specialists and tailored specifically for multilingual learners.

Mathematics (MA): Students take one course in mathematics that focuses on developing logical skills, problem solving, and/or computation. Example courses include logic, proof writing, discrete mathematics, calculus, linear algebra, and statistics.

Disciplinary Perspectives

The liberal arts tradition in education includes a deep commitment to intellectual breadth. Each academic discipline provides a unique lens through which we can understand the world. Scholars and practitioners in distinct disciplines frame questions differently, utilize different sources of knowledge, and practice different methods of inquiry. These include interpretive and analytical modes of inquiry, creative and expressive forms of inquiry, and scientific approaches to studying both the natural and social worlds.

To explore these diverse disciplinary perspectives and how their distinct lenses and tools can be used to understand the world, students take at least 2 courses and 7 credits in each of the 4 areas below:

- **Interpreting and Understanding Human Experience (HE):** Courses in this category utilize analytical, critical, and interpretive forms of inquiry and focus on the human condition in different historical, cultural, linguistic, religious, philosophical, artistic, and literary contexts.
- **Creating and Expressing through Arts and Languages (AL):** Courses in this category utilize creative and/or expressive forms of inquiry and focus on communication and artistic practice.
- **Investigating the Natural World (NW), including 1 lab (LS):** Courses in this category utilize scientific forms of inquiry and focus on natural phenomena in the world around us and the nature of life, matter, and the universe. The lab enables students to practice scientific forms of inquiry and gain firsthand experience with natural and physical phenomena.
- **Investigating the Social World (SW):** Courses in this category utilize social scientific modes of inquiry and focus on human behavior, culture, and society, and forms of social, political, and economic organization.

Across coursework in the Disciplinary Perspectives and in students' individual program of studies (e.g., major, minor, free electives), students must satisfy 3 encounters in each of the following areas: Contemporary Challenges (CC), Quantitative Reasoning (Q), and Writing (W).

- **Contemporary Challenges Encounters (CC):** Through courses designated as Contemporary Challenges Encounters (CC), students grapple with complex, large-scale challenges of the modern world, including the themes of social difference and power, sustainability, and conflict and security.
- **Quantitative Reasoning Encounters (Q):** Through courses designated as Quantitative Reasoning Encounters (Q), students practice interpreting quantitative information, learn about applications of quantitative reasoning within disciplines, and build confidence in their own quantitative abilities.
- **Writing Encounters (W):** Through courses designated as Writing Encounters (W), students practice engaging thoughtfully in the process of writing, learn about discipline-specific styles of writing, and build confidence in their own writing abilities.

Major Degree Programs in the College

Bachelor of Arts and Bachelor of Science Degree Programs

Two distinct bachelor-degree programs are offered by the College are the Bachelor of Arts (BA) and the Bachelor of Science (BS).

Bachelor of Arts degrees typically include fewer major requirements, allowing more opportunities for coursework outside of the major curriculum. Students in a BA program have more flexibility to pursue a minor(s), and study abroad or experiential learning. Bachelor of Science degrees (offered in designated disciplines), require more extensive coursework in the major and collateral fields. Except for this distinction, the same basic requirements must be met for both degree programs (including the minimum number of 120 hours for graduation and the minimum grade point average in the major of 2.0). **No more than six hours of advanced military science credit or creative inquiry (CINQ) coursework may be applied toward either degree.**

Bachelor of Arts Degree

ba degrees are offered in the following areas:

ARTS

Architecture, Art, Art History, Design, Music, Theatre

HUMANITIES

Asian & Asian American Studies, English, Latin American & Latino Studies, Modern Languages & Literatures (Chinese, French & Francophone Studies, German Studies, Japanese, Spanish & Hispanic Studies), Philosophy, Religion, Culture, & Society

Social Sciences

Africana Studies, Anthropology, Cognitive Science, Economics, Environmental Studies, Global Studies, Health, Medicine & Society, History, International Relations, Joint Global Studies & Modern Languages & Literatures, Joint International Relations & Economics, Joint International Relations & Modern Languages & Literatures, Journalism, Journalism/Science Writing, Political Science, Psychology, Sociology, Sociology & Anthropology, Women, Gender & Sexuality Studies

Mathematics & Natural Science

Astronomy, Biology, Chemistry, Computer Science, Earth & Environmental Science, Mathematics, Molecular Biology, Neuroscience, Physics, Statistics & Data Science

BA degrees in pre-dental or pre-optometry science are available to students who are admitted to those combined degree programs (see Pre-Health Professional Programs below).

Bachelor of Science Degree

BS degrees are offered in the following areas:

Astrophysics, Biochemistry, Biology, Chemistry, Cognitive Science, Computer Science, Earth & Environmental Science, Economics, Mathematics, Molecular Biology, Neuroscience, Pharmaceutical Chemistry, Physics, Psychology, Statistics & Data Science

MAJOR FIELD OF CONCENTRATION

By majoring in a specific discipline a student establishes a foundation of knowledge and develops expertise and intellectual sophistication in their field. Students in the College of Arts & Sciences can declare their major after their first semester, and are expected to do so by the end of their fourth semester. The minimum number of credits for a major is 32. A student must maintain a minimum grade-point average of 2.0 in the major field, and in the entire coursework.

major advising

When a student declares a major they are reassigned from a first-year advisor to a major advisor from that department or program's faculty. The major advisor assists students with course selection, research opportunities, internship selection, and other areas of professional development. In all cases, the final responsibility for meeting both major and non-major requirements rests with the student.

Special interdisciplinary majors

In addition to our established major programs, specially structured interdisciplinary majors linking multiple disciplines are possible. For example, a student interested in a professional school of urban or regional planning might wish to structure a special major consisting primarily of courses in political science, environmental studies, sociology, or any other relevant disciplines.

Any student may, with the aid of faculty members chosen from the disciplines involved, devise an interdisciplinary major program to include no less than 32 credits of related course work, with at least 15 credits from advanced courses. The major advisors and the dean of the college must approve the program.

Multiple majors & Dual degrees

A student who wishes to fulfill the requirements for more than one major program has two standard options: a double major or a dual degree. A double major is a single BA degree with two majors. A student pursues a double major by declaring both majors. Typically, double majors can be completed in four years, but declaring late, the sequencing of courses, and time conflicts with required courses can

delay time to degree completion. **No more than three overlapping courses may be used to meet both majors' requirements.**

Students are able to pursue a double major as a Bachelor of Arts (BA) through the College of Arts & Sciences (CAS) and the College of Health (COH) and will follow a special set of distribution requirements that allow for certain areas of overlap between the two colleges' distribution requirements. Students are required to take one first-year seminar in either the CAS or COH, and two semesters of First-Year Writing. One Mathematics (MA) course must be completed for a minimum of 3 credits, as well as two courses Investigating the Natural World (NW), for 7 credits, of which 1 credit must be earned a lab associated with a science lecture. In addition to traditional NW courses, CGH 103 may be taken toward this requirement. Two Interpreting and Understanding the Human Experience (HE) courses are required for 7 credits, of which one course may be chosen from POPH 003 or 319, and overlap with the COH Bioethics requirement. Two Creating and Expressing through Arts and Languages (AL) courses are required for 7 credits, which may overlap with the COH collateral language requirement. Two Investigating the Social World (SW) courses are required for 7 credits, of which traditional SW courses as well as CGH 104 and 105 may be used and overlap with the COH Determinants of Health requirement. Students are required to take three courses designated in Writing (W) for a minimum of 6 credits, which may be a combination of the Advanced Writing requirement in COH and Writing Encounters in CAS. Students are required to take three courses designated in Quantitative Reasoning, and up to two of these may come from BSTA coursework. Students are required to take three courses designated in Contemporary Challenges (CC) for a minimum of 6 credits and up to two of these may come from the Diversity, Equity, and Inclusion (DEI) and Sustainability requirement through COH.

A dual degree program is a combined BA and BS program or two BS degrees in one or more of our undergraduate colleges. For example, the BA offered by the College of Arts & Sciences may be combined with a BS in CAS or in one of the other undergraduate colleges. A student pursues a dual degree by declaring the first program and then requesting the second degree program by filling out a Dual Degree Petition Form, which must be accompanied by an approved semester-by-semester academic plan. The dual-degree student must satisfy major and distribution requirements for both degrees and earn a minimum of 30 additional credits beyond those required for the first degree. All of the 30 additional credits must be taken at Lehigh or in Lehigh residency programs. The requirement of 30 additional credits typically requires additional study beyond 8 semesters. There is no limit on the number of overlapping courses between two degrees, but there must be at least 30 credits of stand-alone coursework in each degree program. For administrative purposes, students who take two degrees or two majors must designate one as their primary major or primary degree program.

Minor Programs

There are dozens of minor programs available to students both in and out of the College of Arts & Sciences. Minors require a minimum of 15 credits, but the specific content is determined by the department, division, or program offering that minor. A minor is optional, and requires a 2.0 minimum grade-point average. No course in a minor program may be taken with Pass/Fail grading. **No more than one course may be double-counted toward a major and a minor, and no more than one course may overlap between two minors.**

Students also have the opportunity to pursue and/or apply to minor programs in the other undergraduate colleges and should review their requirements in their catalog listing. These include, among others, the Business Minor program, Biostatistics, Community Health, Education, the Engineering minor, Entrepreneurship, Global Health, Health Policy & Politics, Indigenous Peoples Health, Marketing, Maternal & Child Health, Population Health, Real Estate, and Supply Chain Management.

ECKARDT SCHOLARS PROGRAM

The Eckardt Scholars Program is a highly selective and unique honors program in the College of Arts & Sciences. The program prioritizes intellectual curiosity, independent work, and close mentoring relationships between students and faculty. Each incoming class includes approximately twenty Eckardt Scholars. These students receive unique academic privileges that provide them with great opportunities at Lehigh and beyond. Students in the program are exempt from the Arts & Sciences distribution requirements and work with their major advisor and the Eckardt Scholars Program Director to create a flexible course of study that best suits their academic interests and ambitions. Although exempt from distribution requirements, students will complete the requisite number of credits for their degrees and all correlative requirements for their majors. The program includes participation in two Eckardt Scholar Seminars and completion of an independent project (e.g., a thesis, artistic creation, or other capstone experience) during the senior year.

Participation in the Eckardt Scholars Program is restricted to only the most well-qualified students. Some students are invited to enroll when first admitted to Lehigh, while others are identified by faculty and encouraged to apply during their first few semesters. Admission to the program is decided on the basis of academic records, written statements of educational goals, and at least two faculty recommendations.

INTERNSHIPS

Many departments and programs offer credit for specific internship experiences. Students should consult with their home department for information on arranging internships. The University faculty has established three important criteria that must be met by all internships: 50 hours of work are required for each credit awarded, no credit can be awarded for an internship *ex post facto*, and the student must register for the internship course during the same term that the internship work is performed. Students must pre-arrange all internship experiences with the appropriate department. Internship credits cannot be awarded for work experiences lacking a distinct, identifiable educational component. A memorandum of understanding circulated among the employer, student, and departmental internship course director helps to promote a common understanding of the educational and work objectives of the internship. Students are advised that not all work experiences advertised as “internships” warrant academic credit, even though they may be otherwise worthwhile.

PRE-LAW PROGRAM

In keeping with the policy of the Association of American Law Schools, the university does not have a prescribed pre-law curriculum; however, Lehigh has a strong pre-law tradition. Successful candidates for law school demonstrate skills in critical analysis, logical reasoning, and communication and have pursued rigorous coursework of significant breadth and depth. Lehigh students have attained entrance to law schools from diverse curricula in all three of the undergraduate colleges. Specifically law-related courses are offered in the College of Arts & Sciences (e.g. Constitutional Law and Politics, Civil Rights and Civil Liberties, Law and Order) and the College of Business (e.g., Introduction to Law and Legal Environment of Business).

Advising is available to prospective pre-law students on a continuous basis from first-year orientation through the law school application process in the senior year. The pre-professional advisor in the Center for Career and Professional Development coordinates these pre-law counseling services.

PRE-HEALTH PROFESSIONAL PROGRAMS

Schools of medicine, dentistry, optometry, podiatry, and veterinary medicine stress the importance of a strong liberal arts education as well as prescribed studies in the sciences. Although most pre-health students will choose a major in a pure or applied science, as long as candidates have the essential courses in biology, chemistry, physics, and mathematics, they may major in any of the three undergraduate colleges.

A health professions advisory committee, which includes the pre-professional advisor and faculty members from the sciences and social sciences, provides career and academic counseling and works closely with students from first-year orientation through the entire process of applying to professional schools. Students with an interest in the health professions are urged to consult with the pre-professional advisor in the Center for Career and Professional Development as early as possible in their academic career.

Combined-Degree Program in Dentistry

In cooperation with the School of Dental Medicine at the University of Pennsylvania, Lehigh offers an accelerated program that enables selected students to earn both the baccalaureate degree (B.A.) with a major in predental science and the doctor of dental medicine degree (D.M.D.) after seven years of study at the two institutions. In the first three academic years at Lehigh, credit hours are earned toward the 120 credits required for the baccalaureate degree. The next four years are spent in the regular program of dental education at the Penn School of Dental Medicine in Philadelphia. By successfully completing their first year at the dental school, students acquire the necessary additional credit hours for the Lehigh baccalaureate degree.

During their first three years at Lehigh, students are expected to make satisfactory progress in prescribed academic areas as well as in the area of personal growth, developing those attributes ultimately needed to become a dentist. Penn Dental School receives student grades and monitors student progress through feedback from Lehigh. Students are expected to attain specified grade point averages and DAT scores. Students' undergraduate credentials are processed through the Admissions Committee of Penn Dental School before a final definitive acceptance is offered. The dental college reserves the right to withdraw an acceptance, or require that a student spend additional time on the undergraduate level, on the grounds of academic or personal maturation concerns.

Application for admission to this program is made through Lehigh's Office of Admissions. Application deadline is January 1.

Required Science and Math Courses

Chemistry		
Select one of the following:		8
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
Physics		
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Select one of the following:		4-5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
Math		
Select one of the following:		4
MATH 012	Basic Statistics and Data Science	
BIOS 130	Biostatistics	
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Total Credits		**54-56**

Required Non-Science Courses

Big Questions Seminar	3-4
First Year Writing Courses	6
Interpreting & Understanding the Human Experience (HE)	7
Creating & Expressing through Arts & Languages (AL)	7
Investigating the Natural World (NW), including one lab (LS)	7
Investigating the Social World (SW)	7
Across their science and non-science coursework, students must also satisfy 3 encounters in each of the following areas:	
Contemporary Challenges (CC)	
Quantitative Reasoning (Q)	
Writing (W)	
Total Credits	**37-38**

Combined-Degree Program in Optometry

In cooperation with the State University of New York College of Optometry in New York City, Lehigh offers an accelerated program in which students may earn both the baccalaureate degree (B.A.) with a major in behavioral neuroscience and the doctor of optometry degree (O.D.) after seven years of study at the two institutions. In the first three academic years at Lehigh, credit hours are earned toward the 120 credits required for the baccalaureate degree. The next four years are spent in the regular program of optometry education at SUNY College of Optometry. By successfully completing their first year at the optometry college, students acquire the necessary additional credit hours for the Lehigh baccalaureate degree.

SUNY College of Optometry receives student grades and monitors student progress through feedback from Lehigh. Students are expected to attain specified grade point averages and OAT scores. Students' undergraduate credentials are processed through the Admissions Committee of SUNY Optometry before a final definitive acceptance is offered. The optometry college reserves the right to withdraw an offer of acceptance on the grounds of academic or personal maturation concerns.

Students may apply to this program either during their initial application or during their enrollment at Lehigh. Application for incoming students is made through Lehigh's Office of Admissions. Application deadline is January 1.

Required Science and Math Courses

Chemistry		
Select one of the following:		8
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4

BIOS 130	Biostatistics	4
or MATH 012	Basic Statistics and Data Science	
BIOS 235	Human Physiology	3
BIOS 324 & BIOS 325	Microbiology and Microbiology Laboratory	5
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
Physics		
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Select one of the following:		4-5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
Math		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Psychology		
PSYC 001	Introduction to Psychology	4
Total Credits		**66-68**

Required Non-Science Courses

Big Questions Seminar	3-4
First Year Writing courses	6
Interpreting & Understanding the Human Experience (HE)	7
Creating & Expressing through Arts & Languages (AL)	7
Investigating the Natural World (NW), including one Lab Science (LS)	7
Investigating the Social World (SW)	7
Across their science and non-science coursework, students must also satisfy 3 encounters in each of the following areas:	
Contemporary Challenges (CC)	
Quantitative Reasoning (Q)	
Writing (W)	
Total Credits	**37-38**

Africana Studies

Website: http://aas.cas.lehigh.edu/

The purpose of the Africana Studies Program is to engender in Lehigh students an intellectual appreciation of the life and culture of peoples of sub-Saharan Africa and the worldwide diaspora, especially in the Americas (the United States and Canada, the Caribbean, Central and South America), thereby enriching the Lehigh curriculum and increasing its relevance to a culturally diverse society and world. In the best tradition of a liberal arts education, Africana Studies expands Lehigh students' critical understanding of their own heritage in interaction with other cultures.

The major and minor in Africana Studies constitute an interdepartmental and comparative program of study for undergraduates who wish to integrate the insights and methods of several disciplines to understand the history, culture, social, and political experience of people of African descent globally.

With the breadth and depth of the curriculum, the Africana Studies Program prepares students for a diverse range of careers. Alumni of the Africana Studies Program have advanced to careers in the arts, law, politics, and academia, among others, and with foci on immigration, mass incarceration, and activism. We encourage majors and minors to speak with the program director and/or their advisors to learn more about the applicability of Africana Studies to a wide range of careers.

Emeritus Faculty

Edward P. Morgan (1976, 1989), university distinguished professor of political science. B.A., Oberlin,1968; M.A., Brandeis, 1973; Ph.D., 1975.

THE MAJOR

The major in Africana Studies consists of a minimum of ten (10) courses, constituting a minimum of 32 credit hours with no more than 12 transfer credits permitted. The major is designed to familiarize students with a range of disciplinary approaches to Africana Studies. It entails training across disciplinary lines as well as the option to focus on a particular area of concentration.

Introductory Course		**4**
AAS 003	Introduction to Africana Studies	
Breadth Courses [1]		**9-12**
Select one course from each concentration below.		
Social & Behavioral Sciences		
History, Religion, or Philosophy		
Visual & Performing Arts or Literature		
Elective Coursework [1,2]		**15-20**
Select five elective courses (see list below).		
Senior Seminar		**4**
AAS 389	Seminar in Africana Studies	
Experiential Learning		
Africana Studies majors are required to satisfactorily participate in experiential learning. This requires the approval of the director and may take the form of long- or short-term study abroad, internship with or without academic credit, service learning, or community engagement. The program director and faculty will offer guidance to assist you in the completion of this requirement.		
Total Credits		**32-40**

1

In consult with the Africana Studies advisor, students can choose from a wide variety of Africana Studies courses each semester, including but not limited to the electives within each Breadth.

2

Majors have the option to declare a major concentration in a chosen field of Africana Studies by completing a minimum of nine credits of elective coursework in one of the fields; including, Arts, Culture, and Science; Gender and Sexuality; Social and Political Movements; Race, Ethnicity, and Class; or self-designed concentration that is developed with faculty advisor or director. A major concentration allows students to develop expertise on a particular subject matter and may be self-designed with the approval of the student's advisor or direction. Students are advised to plan their course of study in consultation with the director and/or designated faculty advisor.

Departmental Honors

Africana Studies majors who attain a 3.5 grade point average in the major and a 3.2 grade point average overall may apply for departmental honors. Students must receive permission from the program director and complete a minimum of 4 credits of AAS 390 Honors Thesis.

THE MINOR

The minor consists of a minimum of four (4) courses, constituting at least 15 hours of study that includes an introductory course and at least one course at the 200-level or above.

Introductory Course		**4**
AAS 003	Introduction to Africana Studies	
Elective Coursework and/or Breadth Courses [1,2]		**11-12**
Social & Behavioral Sciences		
History, Religion, or Philosophy		

Visual & Performance Arts or Literature	
Total Credits	**15-16**

[1]

In consult with the Africana Studies advisor, students can choose from a variety of Africana Studies courses each semester, including but not limited to the electives within each Breadth.

[2]

Must include at least one course at the 200-level or above.

CORE AND ELECTIVE COURSES

Core courses concentrate on subject material directly relevant to the study of past and present experiences of people of African descent. Each semester, a complete list of Africana Studies course offerings can be found on the Africana Studies website or in the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280. In addition, students are encouraged to pursue independent study opportunities to enhance their knowledge of specific aspects of Africana Studies.

Social and Behavioral Sciences		
AAS/SOC 103	Race and Ethnicity in the Contemporary U.S.	4
AAS/LAS/SOC 106	Race and Ethnicity in the Americas	4
AAS/SOC/LAS 155	Afro-Latino Social Movements in Latin America & the Caribbean	4
AAS/SOC 166	Wealth and Poverty in the United States	4
AAS/POLS 205	The Political Development of American Race Relations	4
AAS/POLS/WGSS 210	Revolution on Campus	4
AAS/POLS 230	Social Movements From the 1960s to Present	4
AAS 278	Race, Sports, Media and Social Activism	4
AAS 305	Residential Segregation: Policies and Practices	4
AAS 314	Infections and Inequalities: HIV, TB and Malaria in the Global South	4
AAS/ANTH/GS 317	So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development	4
AAS/JOUR 333	Reporting the Crises: Identity, Journalism and Power	4
AAS/ASIA/GS/POLS 343	Global Politics of Race: Asia and Africa	4
AAS/COMM 375	Global Media and Culture	4
AAS/SOC 379	Race and Class in America	4
History, Religion, Philosophy		
AAS/HIST 005	African Civilization	4
AAS/PHIL 117	Race, Racism, and Philosophy	4
AAS/HIST/WGSS 126	How Black Women Made Modern America	4
AAS/HIST 130	African American History	4
AAS/HIST/GS/WGSS 131	Women, Gender, Sexuality and Race in African Societies	4
AAS/HIST 134	History and Cultures of Ghana	4
AAS/GS/HIST/HMS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness	4
AAS/GS/HIST 178	Globalization and Health in Ghana	3
AAS/HIST 179	Black Political Thought in America	4
AAS/HIST/WGSS 322	African Women, Voices and Lives	4
AAS/HIST 330	Africans and the Atlantic World	4
AAS/HIST 331	United States and Africa	4
AAS/HIST 332	Slavery and the American South	4
AAS/GS/HIST 341	Global Africa: Aid, Volunteerism, NGO's and International Studies	4
Visual & Performing Arts and Literature		
AAS 038	Introduction to African Literature	3
AAS/THTR 066	Hip Hop Dance	2
AAS/THTR 076	Hip Hop Dance II	2
AAS/ENGL/JST/REL 102	Promised Lands: Jewish and African American Children's Literature	4
AAS/ENGL 121	Topics in African-American Literature	4
AAS/ART/GS 124	Arts of the Black World 16th-20th Centuries	4
AAS/ART/GS 125	Art and Architecture of Africa from Colonial to Contemporary Times	4
AAS/MUS 128	Jazz History I	3
AAS/MUS 129	Jazz History II	3
AAS/THTR 132	Hip Hop Theatre	4
AAS/ENGL 138	Introduction to African American Literature	4
AAS/THTR 140	African American Theatre	4
AAS/FREN 312	Modernity in the Maghreb	4
AAS/ENGL 318	Topics in African American Literature and Culture	4
AAS/ENGL 320	Imagining Freedom: 19th-Century African American Literature and Politics	4
AAS/ENGL 325	The Harlem Renaissance: Early 20th-Century African American Literature, Art and Politics	4
ENGL 366	Topics in British Eighteenth-Century Literature	4

GRADUATE CERTIFICATE IN AFRICANA STUDIES

A Graduate Certificate in Africana Studies is offered in the College of Arts and Sciences. Candidates for the certificate must complete 12 credit hours (4 courses) at the 300-level or above, with no more than 6 credits at the 300-level.

The Graduate Certificate in AAS is designed as a complement to a graduate program (e.g. English, History, Sociology, American Studies, Political Science) or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of Africana Studies. In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the AAS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons.

4 courses from the list below at the 300-level or above	**12**
with no more than 6 credits at the 300-level	

COURSES

Additional courses may be chosen in consultation with the program director.

AAS/SOC/WGSS 310	Course AAS 310 Not Found
AAS/FREN 312	Modernity in the Maghreb
AAS/SOC 313	Course AAS 313 Not Found
AAS/HMS/SOC/GS 314	Infections and Inequalities: HIV, TB and Malaria in the Global South
AAS/ENGL 318	Topics in African American Literature and Culture
AAS/ANTH/GS 324	Course AAS 324 Not Found
AAS/HIST 330	Africans and the Atlantic World
AAS/HIST 331	United States and Africa
AAS/HIST 332	Slavery and the American South
AAS/HIST 335	Course AAS 335 Not Found
AAS 339	Course AAS 339 Not Found
AAS/GS/HIST 341	Global Africa: Aid, Volunteerism, NGO's and International Studies

AAS/ASIA/GS/POLS 343	Global Politics of Race: Asia and Africa
AAS/SOC 345	Colonialism and the Black Radical Tradition
AAS/COMM 375	Global Media and Culture
AAS/COMM/WGSS 376	Course AAS 376 Not Found
AAS 376/SOC 379	Course AAS 376 Not Found
AAS 382	Seminar on a topic in Africana Studies
AAS 391	Special Topics in Africana Studies
HIST 367	Rise and Fall of the Old South
POLS 430	Social Movements From the 1960s to Present
POLS 443	Global Politics of Race: Asia and Africa
SOC/WGSS 365/SOC 465/WGSS 465	Course SOC 365 Not Found
SOC 374	Social Stratification: Race, Class, Gender
SOC 443	Course SOC 443 Not Found

Courses

AAS 003 Introduction to Africana Studies 4 Credits
An interdisciplinary examination of the roots, culture, and politics of the modern black world through study of classic works in Africana Studies with emphasis on the continuities among African peoples worldwide and the social forces that have shaped contemporary black life in Africa and the Americas.
Attribute/Distribution: CC, SS, SW, W

AAS 005 (HIST 005) African Civilization 4 Credits
Sub-Saharan Africa through the millennia of the ancient world to the present. Human origins, state and non-state systems, the external slave trade; colonialism, resistance to European rule; independence movements; neocolonialism.
Attribute/Distribution: SS

AAS 025 (REL 025) Introduction to Black Religions and Hip-Hop 4 Credits
Rapper KRS ONE once stated that, “Rap is something you do and Hip-Hop is something you live.” This course thinks through the global evolution of Hip-Hop culture and the public and academic study of Black Religions as responses to structural and historical inequality and the search for meaning in culture by considering themes of resistance, constraint, power, the body, deviance, and morality over and against race, class, gender, and sexuality from a range of academic and cultural sources.
Attribute/Distribution: HU

AAS 038 (ENGL 038) Introduction to African Literature 3 Credits
Sub-Saharan African literary themes and styles, historical and social contexts, African folk tales, oral poetry, colonial protest literature, postcolonial writing, films on contemporary Africa.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

AAS 066 (THTR 066) Hip Hop Dance 2 Credits
Techniques, vocabulary, and history behind the various elements of the Hip Hop Movement. Focus upon the cultural influence of Hip Hop dance styles, and the overall social influence of the Hip Hop Movement.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

AAS 076 (THTR 076) Hip Hop Dance II 2 Credits
Students familiar with the music genres and basic dance tropes of the Hip Hop movement will explore, develop, and apply them in combinations that weave the various elements of Hip Hop culture into a high energy dance. Focus on Hip Hop dance as it influences the contemporary world view and global aesthetics.
Repeat Status: Course may be repeated.
Prerequisites: THTR 066 or AAS 066
Attribute/Distribution: AL, HU

AAS 091 Special Topics 1-4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

AAS 095 1-4 Credits
Repeat Status: Course may be repeated.

AAS 102 (ENGL 102, JST 102, REL 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: CC, HE, HU, W

AAS 103 (SOC 103) Race and Ethnicity in the Contemporary U.S. 4 Credits
Examines race and ethnicity from a sociological perspective. Focus on the role of the major racial and ethnic communities in modern American society. Explores the roles of race and ethnicity in identity, social relations, and social inequality. Topics include racial and ethnic communities, minority/majority groups, assimilation, prejudice/discrimination, identity and the social construction of the concept of “race.”
Attribute/Distribution: SS

AAS 106 (LAS 106, SOC 106) Race and Ethnicity in the Americas 4 Credits
How is it possible that someone who is officially considered black in the United States can embody different racial identities throughout current Latin America? Even more, how is it possible that people considered white nowadays were not officially so in early twentieth-century US (although they were viewed as white in the Latin American context at the same time period)? This course offers a historical comparative analysis of the nature and dynamics of race between the United States and Latin America.
Attribute/Distribution: CC, SS, SW, W

AAS 117 (PHIL 117) Race, Racism, and Philosophy 4 Credits
An introduction to the philosophy born of struggle against racism and white supremacy. We will read the work of philosophers, mostly European, who quietly made modern racism possible by inventing the category of race, but we will concentrate on the work of philosophers, mostly of African descent, who for 200 years have struggled to force a philosophical critique of the category of race and the practice of white supremacy.
Attribute/Distribution: CC, HE, HU, W

AAS 121 (ENGL 121) Topics in African-American Literature 4 Credits
Selected works of African American literature and/or the literatures of the African Diaspora. Must have completed six hours of first-year English. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

AAS 124 (ART 124, GS 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the AnteBellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santería), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

AAS 125 (ART 125, GS 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

AAS 126 (HIST 126, WGSS 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women's historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: CC, HE, HU

AAS 128 (MUS 128) Jazz History I 3 Credits
A study of the roots of jazz. Starting in West Africa, the course traces the synthesis of African and European elements to 1945. Musicians covered are Gottshalk, Bolden, Morton, Armstrong, Hawkins, Basie, Ellington, and others.
Attribute/Distribution: CC, HE, HU

AAS 129 (MUS 129) Jazz History II 3 Credits
A survey of modern jazz from 1945 to present. Musicians covered include Parker, Gillespie, Monk, Davis, Coltrane, Hancock, and Coleman. Can be taken independently of Jazz History I, but the first course would be helpful.
Attribute/Distribution: CC, HE, HU

AAS 130 (HIST 130) African American History 4 Credits
Blacks in America from the first importation of Africans to the implementation of civil rights laws. West African origins, slave trade, slavery, free blacks and emancipation and study of Reconstruction, segregation, urbanization, and the struggle for racial equality.
Attribute/Distribution: CC, HE, SS, W

AAS 131 (GS 131, HIST 131, WGSS 131) Women, Gender, Sexuality and Race in African Societies 4 Credits
This course explores the various ways in which womanhood, gender, sexuality and race are defined, constructed and articulated in African societies. The interdisciplinary course draws from historical writings, novels, biography, anthropology, political science, health and other fields to examine diverse activities and contributions of African women from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

AAS 132 (THTR 132) Hip Hop Theatre 4 Credits
Introduction to the creation and performance of Hip Hop Theatre. Exploration of the history and culture of Hip Hop through original written material, live performance, music, film, video and web based content. Public Performances. Must have audition. Consent given by instructor.
Attribute/Distribution: AL, CC, HU

AAS 134 (HIST 134) History and Cultures of Ghana 4 Credits
Overview of Ghana's history and cultures from the fifteenth century, examining diversity among various ethnic groups and covering such themes as religion, literature, art, music/dance, gender, family and anti-colonial movements. The course will also explore how slave castles/forts contributed to the transatlantic slave trade, Pan-Africanism and global tourism.
Attribute/Distribution: CC, HE, HU, W

AAS 138 (ENGL 138) Introduction to African American Literature 4 Credits
Survey of African American prose narrative and poetry from the 18th century to the present. Features writers from the Harlem Renaissance, the Black Arts Movement, and the post Black Power era.
Attribute/Distribution: HE, HU, W

AAS 140 (THTR 140) African American Theatre 4 Credits
Foundations of African theater: historical, literacy, and practical.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU

AAS 144 Global Hip Hop and Social Change 4 Credits
Hip Hop has become a global phenomenon. We will analyze how and why socially Conscious Hip Hop, as a tool for social change, has expanded to Latin America, Africa, and the Middle East.
Attribute/Distribution: SS, SW

AAS 147 (COMM 147) Dreams and Nightmares: The Music Industry, Media and Inequality 4 Credits
What were the racial and gendered stakes when Kanye West interrupted Taylor Swift at the MTV Video Music Awards? How do sexual assaults by famous musicians go under-investigated and under-covered? What are the structures of the music industry that enable inequity? This course addresses these questions and problematic hierarchies within the global popular music industry, situates musical case studies in social, news and entertainment media environments, and highlights the role of music journalism in setting the terms of key debates.
Attribute/Distribution: SS, SW

AAS 155 (LAS 155, SOC 155) Afro-Latino Social Movements in Latin America & the Caribbean 4 Credits
This focuses on Afro-Latinos who make up nearly 70% of the population of the Americas. Despite the large amount of people of African descent living in the Americas, Afro-Latinos are an understudied population who face significant amounts of racial discrimination in their countries. Who are Afro-Latinos? Where do they live? How are they challenging the racism that they face? These are questions we will tackle in this course.
Attribute/Distribution: CC, SS, SW

AAS 163 (SOC 163) Sociology of Hip Hop Culture 4 Credits
Hip Hop culture is a complex form of artistic practices reflecting and impacting the environments in which they were produced. Through readings, music and video, this class will uncover the origins of Hip Hop by examining the musical history of the Afro-diaspora in the 20th century. Further study will reveal how the young Bronx, NY underclass in the 1970s fused elements of past musical styles with their own personal and political expression that sparked a worldwide phenomenon and culture industry.
Attribute/Distribution: CC, SS, SW

AAS 164 (SOC 164, WGSS 164) Sociology of Black Families 4 Credits
The objective of this course is to help students learn more about Black family experiences within the United States and globally. In approaching the course with an intersectional lens, students will learn about the varied experiences of Black families, and the ways in which these experiences are embedded in empowerment, disempowerment, and self-actualization. Students will leave the course understanding Black families at the intersection of fatherhood, motherhood, marriage, singlehood, childrearing, LGBTQ families, interracial families, transnational families, and aging.
Attribute/Distribution: CC, SS, SW

AAS 166 Wealth and Poverty in the United States 4 Credits
Examines the sociology of wealth and poverty affluence and disadvantage, “rags and riches” in American Society. Focus is a critical analysis of the wealth gap, its causes, consequences and social context. We will consider the roles of wealth and poverty in determining life chances and structuring opportunity, as well as their roles in the perpetuation of social inequality across generations. We will address contemporary debates surrounding public policy, tax laws, antipoverty programs and other reform efforts aimed at decreasing the.
Attribute/Distribution: SS, SW

AAS 176 (GS 176, HIST 176, HMS 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students’ final papers will perform a “post-mortem” on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: CC, HE, HU, W

AAS 178 (GS 178, HIST 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: CC, HE, SS, W

AAS 179 (HIST 179) Black Political Thought in America 4 Credits
Black leadership, organizations, and philosophy in America from Reconstruction to the Civil Rights Era; ideas and programs of Booker T. Washington, W.E.B. DuBois, Marcus Garvey, Malcolm X and Martin Luther King, Jr.
Attribute/Distribution: HE, SS

AAS 191 Special Topics 1-4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

AAS 205 (POLS 205) The Political Development of American Race Relations 4 Credits
This course examines the distinctive role race has played in shaping the political history of the United States.
Attribute/Distribution: SS

AAS 210 (POLS 210, WGSS 210) Revolution on Campus 4 Credits
Universities are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.
Attribute/Distribution: CC, SS, SW

AAS 230 (POLS 230) Social Movements From the 1960s to Present 4 Credits
The lessons of U.S. social and political movements from the 1960s and the post-2000 era. Students examine social movements through the lens of intersectionality, with a focus on civil rights, anti-war activism, women’s rights, global justice, and ecology movements, to assess their connection to democracy and citizens’ lives.
Attribute/Distribution: CC, SS, SW

AAS 278 Race, Sports, Media and Social Activism 4 Credits
This course investigates the role and use of media in key efforts of social resistance among American athletes of color. Our analysis will include a look at the lives of athletes who engage in these actions; key acts of resistance; media coverage; and the public response both for and against the protests. Students will learn about media literacy, the power of representation, public sphere protest among celebrities and the role of news media in protest.
Attribute/Distribution: SS, SW

AAS 291 Special Topics 1-4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

AAS 299 Internship in Africana Studies 1-4 Credits
Work experience with an off-campus organization for practical experience in an Africana Studies-related field. Sophomore standing and program director’s approval required. Course may be repeated for up to four credits.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

AAS 305 (EVST 305, POLS 305) Residential Segregation: Policies and Practices 4 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.
Attribute/Distribution: CC, SS, SW

AAS 311 (ANTH 311, FILM 311) African Culture on Film 4 Credits
Cinematic representations of Africans and their culture are nearly as old as cinema itself.This course surveys films depicting African peoples, some made by outsiders but mostly by Africans themselves, to explore questions about culture, identity, race, and power. From ethnographic filmmakers like Jean Rouch and pioneers like Ousmane Sembene through today's flourishing Nollywood industry, cinematic depictions of life on the African continent have changed the way the world sees Africans and their place in the world.
Attribute/Distribution: HU, SS

AAS 312 (FREN 312, MLL 312) Modernity in the Maghreb 4 Credits
Emergence of the modern self through a comparative study of textual as well as visual representations of postcolonial subjects by male and female writers and film makers. Study of the way the sociopolitical context of countries such as Morocco, Algeria and Tunisia informs the constitution of subjectivity within a multicultural and multilingual community. Issues such as patriarchy, nationalism, colonialism, post colonialism, identity, gender, and Islam in North African literature and film from Franco-Arab traditions.
Attribute/Distribution: HU, W

AAS 313 (SOC 313) Keep the Change: Social Movements in Society 4 Credits
Interested in how social change works? Or how to stop it? This seminar provides an introduction to the origins, dynamics, and consequences of historical and contemporary social movements, beginning with the American Civil Rights Movement. Students will discuss and develop their own ideas on these issues through examination of social movement theory and empirical case studies. They will also explore more general questions about the relationship between human agency, social structure, and historical change. More information is available at https://wordpress.lehigh.edu/zim2/soc313/.
Attribute/Distribution: CC, SS, SW

AAS 314 (GS 314, HMS 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: CC, SS, SW, W

AAS 317 (ANTH 317, GS 317) So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development 4 Credits
We are often motivated by the desire to “give back”-- feed the hungry, heal the sick, and help those less fortunate than ourselves. Anthropological research on humanitarian aid, development projects, and other interventions meant to improve human lives in various contexts shows us why these efforts often go awry. Focusing primarily on settings outside the U.S., students will consider the pitfalls of developmental and humanitarian interventions as well as the crucial role of local knowledge in addressing complex global problems.
Attribute/Distribution: CC, SS, SW, W

AAS 318 (ENGL 318) Topics in African American Literature and Culture 3-4 Credits
Special Topics in African American culture and/or the cultures of the African diaspora. Topics may be focused by period, genre, thematic interest or interdisciplinary method including, for example, “Nineteenth-century African American Literature and Politics”, “African-American Folklore”, “Black Atlantic Literature”, “The Harlem Renaissance”, “African-American Women Writers”.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

AAS 320 (ENGL 320) Imagining Freedom: 19th-Century African American Literature and Politics 3-4 Credits
In the midst of slavery and its violent aftermath, African Americans dreamed of freedom. These imaginings of freedom are among the richest cultural legacies of the American people and a necessary part of any effort to understand our nation’s contradictory history. Students will read slave-narratives, novels, poems, protests against slavery and lynching, demands for political rights and women’s equality, calls for slave rebellion and appeals for inter-racial cooperation. Readings include Frederick Douglass, Harriet Jacobs, Sojourner Truth, Harriet Wilson, Charles Chesnutt.
Attribute/Distribution: CC, HE, HU, W

AAS 322 (HIST 322, WGSS 322) African Women, Voices and Lives 3-4 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

AAS 325 (ENGL 325) The Harlem Renaissance: Early 20th-Century African American Literature, Art and Politics 3-4 Credits
Explore the extraordinary flowering of African American literary, artistic and political life in the early 20th century. Study masterpieces of African American literature, music, visual art, and political imagination. Consider how artists and activists represented the diversity of Black life in America and reimagined race relations during the Jim Crow era. Learn how works by Langston Hughes, Zora Neale Hurston, Bessie Smith, Aaron Douglas and many others can assist us in realizing the promise of racial justice.
Attribute/Distribution: CC, HE, HU, W

AAS 330 (HIST 330) Africans and the Atlantic World 4 Credits
This course chronicles the history of Africans and the Atlantic world from the fifteenth century. It explores cross-cultural interactions and exchanges between Africans and Europeans and covers major themes including trade, religion, slavery, abolition, identity, colonialism, gender, the "Back-to-Africa" movements and impact of Africans on Atlantic world history.
Attribute/Distribution: HU

AAS 331 (HIST 331) United States and Africa 3,4 Credits
Reciprocal relationships between North America and the African continent from the slave trade in the seventeenth century to the twentieth century Afrocentric movement; impact of Americans on shaping of modern Africa, Pan-African relations; influence of African Americans on U.S. policies toward Africa.
Attribute/Distribution: CC, HE, SS, W

AAS 332 (HIST 332) Slavery and the American South 3-4 Credits
The emergence and demise of the “peculiar institution” of African American slavery in British North America and the Old South. African background, colonial beginnings, 19th century slave community, the ruling race and proslavery ideology, the death of slavery and its aftermath, slavery and freedom in a comparative context.
Attribute/Distribution: HE, SS

AAS 333 (JOUR 333) Reporting the Crises: Identity, Journalism and Power 4 Credits
This seminar helps students understand the role of journalists, media-makers and citizens at the intersection of identity and inequality in times of crisis. It covers issues of race, class and gender with a specific emphasis on anti-Black racism, showing how media can be consciously or unwittingly used to further discrimination and support ongoing structures and patterns of harm. Ultimately students will explore how new media platforms, organizations and workers might undertake more equitable practices for a more equal media future.
Attribute/Distribution: CC, SS

AAS 341 (GS 341, HIST 341) Global Africa: Aid, Volunteerism, NGO's and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: CC, HE, SS, W

AAS 343 (ASIA 343, GS 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of "race" and its impact on domestic and international politics.
Attribute/Distribution: SS

AAS 345 Colonialism and the Black Radical Tradition 4 Credits
Karl Marx was not the only figure who developed an influential theory of social revolution. A cadre of theorists from the Global South have extensively theorized about the issues facing their particular nations, and they have developed social theories that have challenged social and global inequality. This course is a theory based course that will focus on the anti-colonial and post-colonial thought of radical black intellectuals from the Black America, the Caribbean, and West Africa.
Attribute/Distribution: SS

AAS 371 Independent Study 1-4 Credits
Independent study in advanced areas of Africana Studies. Independent research with an individual faculty member in the Africana Studies program. Consent of director.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

AAS 375 (COMM 375) Global Media and Culture 4 Credits
Cultural Studies investigates dominant understandings; issues of identity and experience; and society. A Cultural Studies approach to understanding representations of difference in global media. Focus will center upon the role of media in shaping the contemporary dominant understandings of various groups in a globalized world; introductions to philosophies and theories that function as fundamental texts on the relationship between media, social life and human behavior; and the ways in which media socially construct a new, globalized reality.
Attribute/Distribution: SS, W

AAS 379 (SOC 379) Race and Class in America 4 Credits
This course focuses on the ways in which race and class intersect in the social, economic, and political structures of American society. Through sociological literature, fiction, nonfiction, film, and other media we will explore the place of race and class in American society. We will examine how race and class operate on a personal, "micro" level, while at the same time operating on a large scale, "macro" level.
Attribute/Distribution: CC, SS, SW

AAS 382 Seminar on a topic in Africana Studies 1-4 Credits
Advanced study of a subject or issue in Africana Studies not covered in other courses.
Attribute/Distribution: CC, W

AAS 389 Seminar in Africana Studies 4 Credits
An upper-level seminar in Africana Studies will serve as a Capstone experience for Africana Studies majors. The course is also open to non-majors who want to develop their research skills on topics relevant to Africana Studies. The course will expand on students' understanding of Africana Studies based on their prior AAS coursework and will guide them through a research project. Consent of department required.
Attribute/Distribution: CC, HU, SS, W

AAS 390 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of Africana Studies majors who apply for and qualify for graduation with program honors. Students must complete a minimum of 4 Honors Thesis credits and attain a 3.5 grade point average in the major and a 3.2 grade point average overall. Permission of the program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

AAS 391 Special Topics in Africana Studies 3-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

AAS 393 (WGSS 393) Black Feminist Thought and the Media Industries 4 Credits
From the Oscar-winning documentary 20 Feet from Stardom to Lifetime's investigative series Surviving R.Kelly, recent media highlights injustices faced by black women in the media industries. This course historicizes the place of black women within media, introduces students to Black Feminist Thought, and unpacks concepts such as hypervisibility, intersectionality, and womanism. It explores how race and gender manifest in (and are challenged by) the creative industries. Course fills major and minor requirements in AAS and WGSS.
Attribute/Distribution: SS

AAS 422 (HIST 422, WGSS 422) African Women, Voices and Lives 3 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.

AAS 493 (WGSS 493) Black Feminist Thought and the Media Industries 3 Credits
From the Oscar-winning documentary 20 Feet from Stardom to Lifetime's investigative series Surviving R.Kelly, recent media highlights injustices faced by black women in the media industries. This course historicizes the place of black women within media, introduces students to Black Feminist Thought, and unpacks concepts such as hypervisibility, intersectionality, and womanism. It explores how race and gender manifest in (and are challenged by) the creative industries. Course fills major and minor requirements in AAS and WGSS.

Art, Architecture, and Design

The Department of Art, Architecture and Design offers a BA degree in **four majors**: art, architecture, design, with concentrations in both graphic design and product design, and art history. It has **minor programs** in each field, and additional minors including apparel design and museum studies. It is one of the university's largest undergraduate departments, and offers an arts education that combines the depth and focus of disciplinary training with the breadth and flexibility of a liberal arts curriculum. The department also emphasizes hands-on and experiential learning outside the classroom, allowing students to harness the skills they learn in the studio for real-world application—as important tools for inquiry, dialogue, and service in the community and world at large.

Many courses require department permission. Students interested in enrolling in any of the department's courses should contact the department coordinator well before registration period to be eligible to register.

The **art major** centers on a fine arts and studio art education, covering media including drawing, painting, photography, printmaking, and sculpture. Studio work is enhanced by courses in history and theory, and museum and gallery visits both on and off campus.

For the student interested in becoming a creative artist, the major provides a foundation for a life in art, or more immediately, a path into an MFA graduate degree program in fine art. Many students choose to double major, and a major in art combined with a minor in education is available for students interested in becoming primary, secondary, or special education art teachers.

The **architecture major** is a pre-professional program focused on architectural design, complemented by courses in history and theory, building technology, and elective studio courses across the department.

The major provides a comprehensive undergraduate education that is the first step in a series of educational and apprenticeship requirements leading to professional registration and licensing, which will generally require students to continue on to an MArch from an institution offering a graduate program in architecture. The major also prepares students for direct employment in fields that do not require licensing, such as interior design, adaptive reuse, historic preservation, construction management, real estate development, and others. The BA major in architecture is different from a BArch, a professional five-year degree.

The **design major** offers students two tracks of study: in graphic design and product design. Graphic design focuses on visual communication through the use of imagery, typography, and visualization technologies, and students work across multiple platforms, including print media, web and mobile design, and user experience design (UI/UX). Product design focuses on the creation of physical objects of use, their design, prototyping, and production. This includes objects for industrial, household, medical, and transportation use, recreational equipment, furniture, apparel, accessories, jewelry, toys, and exhibit and trade design, among others.

Students majoring in design go on to careers in all areas of graphic design and product and industrial design. This includes advertising, marketing, publishing, packaging design, digital illustration and animation, the design of furniture, medical devices, and apparel, user experience design, service design, and many others.

An **art history** major provides students with a comprehensive education in the history of art, architecture, and museum practice.

Through introductory and advanced coursework, as well as museum and site visits, students learn how to examine, evaluate, and interpret works of art and architecture, and acquire a working knowledge of the methods, theories, and research practices of art historical analysis.

The study of art and its history is a fundamental part of a liberal arts education, and art history is unique among academic fields in the breadth and diversity of its objects of study. Students majoring in art history go on to careers in museums, galleries, auction houses, private art sales, conservation, restoration, cultural heritage and preservation, education, publishing, and many other fields. The major also provides an important foundation for students who plan to pursue advanced graduate studies in the arts and humanities.

Many students in the department choose to **double major** or to pursue a **dual degree**. Popular pairings include Civil Engineering, Computer Science, Industrial and Systems Engineering, Marketing, Management, Mechanical Engineering, and Psychology. Lehigh's **Arts-Engineering program**, a five-year, dual-degree course of study, allows students to link any College of Engineering and Applied Science major program with any College of Arts and Sciences major program, and to earn two degrees, one from each college. It pairs particularly well with majors in Art, Architecture and Design.

All programs in Art, Architecture and Design are multidisciplinary, and students are encouraged to take advantage of the many learning environments of the department and the university. Students have use of the department's 30,000 square feet of studio, lab, and classroom space on Lehigh's Mountaintop Campus, the collections and exhibitions of the Lehigh University Art Galleries, and the facilities and resources of the Lehigh University Design Labs. They are encouraged to make use of these facilities and resources to enhance and enrich their courses, and to help shape their own creative work. Department faculty profiles can be found here. (https://aad.lehigh.edu/facultystaff/)

DEPARTMENTAL HONORS

Exceptional students majoring in the department may in their junior year apply to pursue an Honors Project course for their senior year (ART 389, ARCH 389, DES 389). To be eligible, a student must have attained a 3.5 GPA in the major program and a minimum overall GPA of 3.0. Candidates should submit to the department chair a written proposal for their project, prepared in consultation with a faculty member who will serve as their honors sponsor. The project should result in a research paper, design project, or exhibition. Successful completion of the project will result in a "Department Honors" designation being affixed to the student's transcript.

ART MAJOR

44 credit hours required

Foundation		**20**
ART 001	Art and Architecture History: Ancient to Medieval	
ART 002	Art History: Renaissance to Present	
ART 003	Two-Dimensional Design	
ART 004	Three-Dimensional Design	
ART 011	Drawing I	
History		**4**
Choose one of the following		
ART 220	Modern Art of the 20th Century	
ART 221	Global Contemporary Art	
Studio		**20**
Choose two entry art studios		
ART 007	Digital Photography I	
ART 013	Sculpture I	
ART 015	Figure I	
ART 034	Plein Air Painting I	
ART 035	Painting I	
ART 037	Printmaking I	
ART 052	Introduction to Video Recording and Editing	
Choose one 100 level art studio		
ART 107	Digital Photography II	
ART 111	Drawing II	
ART 113	Sculpture II	
ART 115	Figure II	
ART 134	Plein Air Painting II	
ART 135	Painting II	
ART 137	Printmaking II	
Choose one 200 level art studio		
ART 213	Advanced Sculpture Workshop	
ART 215	Advanced Figure Workshop	
ART 217	Advanced Studio Workshop	
ART 234	Advanced Plein Air Painting Workshop	
ART 247	Advanced Photography Workshop	
Choose one 300 level studio		
ART 317	Departmental Capstone	
ART 373	Studio Art Internship	
ART 389	Honors Project	
DES 385	Fusion: Design Practice	
Total Credits		**44**

ART HISTORY MAJOR

44 credit hours are required.

Foundation	
ART 001	Art and Architecture History: Ancient to Medieval
ART 002	Art History: Renaissance to Present
ART 003	Two-Dimensional Design
ART 004	Three-Dimensional Design
ART 175	Introduction to Museums and Museum Professions
Capstone - 1 course from the following List	
ART 317	Departmental Capstone
ART 389	Honors Project
ART 375	Museum Internship
DES 385	Fusion: Design Practice
Electives - 5 courses from the following list [1]	
See footnote instructions	
ANTH 126	Urban Anthropology
ANTH 173	Archaeology of the Middle East
ANTH 176	Roman Archaeology
ANTH 178	Mesoamerican Archaeology
ARCH 002	History of Architecture
ARCH 159	Modern History and Sustainable Architecture in Munich
ARCH 210	20th Century Architecture
ARCH 342	Theory of Form and Materials
ART 069	Special Topics in Art History
ART/WGSS 121	Women in Art
ART/AAS/GS 124	Arts of the Black World 16th-20th Centuries
ART/AAS/GS 125	Art and Architecture of Africa from Colonial to Contemporary Times
ART 169	Special Topics in Art History
ART 220	Modern Art of the 20th Century
ART 221	Global Contemporary Art
ART 223	Writing Your Way Into the Arts
ART 227	Latin American Art
ART 269	Special Topics in Art History
ART 275	Museum Collections and Exhibitions
ART 276	Museum Education and Interpretation
ART 370	Special Topics in Museum Studies

DES 066	Design History
FILM 001	Introduction to Film
HIST 183	France from Medieval to Modern:Soc., Pol. & Art
HIST 184	Paris: The Global City
HIST 350	19th Century Paris and the Invention of Modernity
PHIL 123	Aesthetics
PHIL 223	Aesthetics Seminar
THTR 126	History of Interior Design and Decor
THTR 129	History of Fashion and Style

1

Additional courses taught in AAD or in other disciplines may be substituted for the classes listed here at the discretion of the student's major advisor. Courses taken during study abroad must be pre-approved with the student's advisor if they are intended to fulfill requirements for the major.

ARCHITECTURE MAJOR

55-56 credit hours are required.

Foundation		**20**
ART 001	Art and Architecture History: Ancient to Medieval	
ARCH 002	History of Architecture	
ART 003	Two-Dimensional Design	
ART 004	Three-Dimensional Design	
ARCH 034	Digital Drawing and 3D Modeling	
Architecture Studios		**16**
ARCH 043	Architectural Design I	
ARCH 143	Architectural Design II	
ARCH 243	Architectural Design III	
ARCH 343	Architectural Design IV	
Studio Elective: Select one (1) of the following		**3-4**
ARCH 071	Special Topics in Architecture	
ARCH 123	Visualization and Fabrication in Architecture	
ARCH 171	Special Topics in Architecture	
ARCH 211	Architectural Drawing/Analysis and Expressions	
ARCH 271	Special Topics in Architecture	
ART 007	Digital Photography I	
ART 011	Drawing I	
ART 013	Sculpture I	
ART 015	Figure I	
ART 034	Plein Air Painting I	
ART 035	Painting I	
DES 040	Product Design I: Form, Process and Concept	
DES 053	Introduction to Graphic Design	
DES 148	Furniture Design I	
History and Theory		**4**
ARCH 210	20th Century Architecture	
Materials and Technology		**8**
ARCH 157	Architectural Technology I	
ARCH 158	Architectural Technology II	
Capstone: Select one (1) of the following		**4**
ARCH 311	Architectural Portfolio	
ARCH 389	Honors Project	
DES 385	Fusion: Design Practice	
Total Credits		**55-56**

Some graduate programs in Architecture require prior college-level Calculus or Physics. Those requirements may be met by the following courses. It is recommended that students discuss their plans with their Academic Adviser.

Mathematics Recommendation		
Select one of the following:		5-8
MATH 021	Calculus I	4
MATH 051	Survey of Calculus I	4
MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	4
Physical Science Recommendation		
PHY 012	Introductory Physics Laboratory I	1
Select one of the following:		
PHY 010	General Physics I	4
or PHY 011	Introductory Physics I	

A typical first-year might consist of:

First Year			
First Semester	**Credits**	**Second Semester**	**Credits**
Big Questions Seminar	3-4	ARCH 002	4
ART 001	4	ART 004 or ARCH 034	4
ART 003	4	MA DISTRIBUTION ELECTIVE	3-4
WRT 001	3	WRT 002	3
	14-15		**14-15**

Total Credits: 28-30

DESIGN MAJOR

48 credit hours required

Foundation		**20**
ART 001	Art and Architecture History: Ancient to Medieval	
ART 002	Art History: Renaissance to Present	
ART 003	Two-Dimensional Design	
ART 004	Three-Dimensional Design	
ART 011	Drawing I	
History		**4**
Choose one of the following:		
ART 220	Modern Art of the 20th Century	
ART 221	Global Contemporary Art	
Core Concentration		**24**
Graphic Design		
DES 053	Introduction to Graphic Design	
DES 153	Graphic Design: Word and Image	
DES 253	Graphic Design: Brand Experience	
Plus three elective studios from following:		
ART 007	Digital Photography I	
ART 035	Painting I	
ART 037	Printmaking I	
DES 040	Product Design I: Form, Process and Concept	
DES 070	Web Design I	
DES 170	Web Design II	
DES 385	Fusion: Design Practice	
Other AAD elective studios can be chosen in consultation with your adviser		
Product Design		
DES 040	Product Design I: Form, Process and Concept	
DES 140	Product Design II: Designing for Others	
DES 240	Product Design III: Materials to Market	
Plus three elective studios from the following:		
ARCH 043	Architectural Design I	

ART 013	Sculpture I
ART 113	Sculpture II
DES 053	Introduction to Graphic Design
DES 070	Web Design I
DES 072	Textile Design I
DES 148	Furniture Design I
DES 172	Textile Design II
DES 248	Furniture Design II
DES 272	Advanced Textile Design Workshop
DES 385	Fusion: Design Practice
Other AAD elective studios can be chosen in consultation with your adviser	
Total Credits	**48**

MINOR PROGRAMS

The Apparel Design Minor introduces students to costume, apparel and accessory design. While developing technical skills and artistic sensibilities, students will create their own textiles and wearables.

The minor consists of 18-20 hours of course work, usually five 3-4 credit courses from the following list:	
DES/THTR 025	Costume Construction I
DES/THTR 026	Costume Construction II
DES/THTR 072	Textile Design I
DES/THTR 089	Introduction to Fashion Design
DES/THTR 129	History of Fashion and Style
DES/THTR 172	Textile Design II
THTR 175	Special Projects
DES/THTR 189	Costume Design
THTR 260	Design and Technical Practicum
DES/THTR 272	Advanced Textile Design Workshop

Architecture Minor (18-20 credits)

Foundation (4 courses):	**16**
ARCH 002	History of Architecture
ARCH 034	Digital Drawing and 3D Modeling
ARCH 043	Architectural Design I
ARCH 143	Architectural Design II
Plus choose one (1) course from the following list:	**2-4**
ARCH 071	Special Topics in Architecture
ARCH 157	Architectural Technology I
ARCH 171	Special Topics in Architecture
ARCH 210	20th Century Architecture
ARCH 243	Architectural Design III
ARCH 271	Special Topics in Architecture
ARCH 343	Architectural Design IV
ART 004	Three-Dimensional Design
ART 013	Sculpture I
DES 040	Product Design I: Form, Process and Concept
DES 053	Introduction to Graphic Design
DES 385	Fusion: Design Practice
Total Credits	**18-20**

Art Studio Minor (18-20 credits)

Foundation (2 courses):	**8**
ART 003	Two-Dimensional Design
ART 004	Three-Dimensional Design
Choose three (3) courses from the following list, one of which must be at the 100-level:	**10-12**
ART/FILM 007	Digital Photography I
ART 011	Drawing I
ART 013	Sculpture I
ART 015	Figure I
ART 034	Plein Air Painting I
ART 035	Painting I
ART 037	Printmaking I
ART 073	Introductory Studio Practice
ART/FILM 107	Digital Photography II
ART 111	Drawing II
ART 113	Sculpture II
ART 115	Figure II
ART 134	Plein Air Painting II
ART 135	Painting II
ART 137	Printmaking II
ART 173	Special Topics in Studio Practice
ART 273	Special Topics in Studio Practice
DES 385	Fusion: Design Practice
Total Credits	**18-20**

Graphic Design Minor (18-20 credits)

Foundation (3 courses):	**12**
ART 003	Two-Dimensional Design
DES 053	Introduction to Graphic Design
DES 153	Graphic Design: Word and Image
Choose two (2) courses from the following list:	**6-8**
DES 040	Product Design I: Form, Process and Concept
DES 070	Web Design I
DES/THTR 072	Textile Design I
DES 073	Special Topics in Design
DES 170	Web Design II
DES 173	Special Topics in Design
DES 253	Graphic Design: Brand Experience
DES 370	Special Topics in Design
DES 385	Fusion: Design Practice
ART/FILM 007	Digital Photography I
ART 011	Drawing I
ART 035	Painting I
ART 037	Printmaking I
ARCH 034	Digital Drawing and 3D Modeling
Total Credits	**18-20**

Museum Studies Minor

Students learn the approaches, history, and theories of museum and collection practices, and how museums provide value to the public. Curriculum topics include how museums are organized and operate, how they care for and interpret collections, how they serve their audiences, how they grapple with complex legal and ethical issues, and their responsibility to the public's trust. The minor consists of a minimum of 15 credits.

Minor requirements:

Minimum 15 credits required		
ART 175	Introduction to Museums and Museum Professions	4
ART 375	Museum Internship	1-4
And choose three courses from the following:		
ART 275	Museum Collections and Exhibitions	4
ART 276	Museum Education and Interpretation	4
ART 370	Special Topics in Museum Studies	1-4
Approved elective course (1-4 credits)		

Product Design Minor (18-20 credits)

Foundation (3 courses)	
ART 004	Three-Dimensional Design
DES 040	Product Design I: Form, Process and Concept

DES 140	Product Design II: Designing for Others
Choose two (2) courses from the following list:	
DES 053	Introduction to Graphic Design
DES/THTR 072	Textile Design I
DES 073	Special Topics in Design
DES 148	Furniture Design I
DES/THTR 172	Textile Design II
DES 173	Special Topics in Design
DES 240	Product Design III: Materials to Market
DES 248	Furniture Design II
DES 370	Special Topics in Design
DES 385	Fusion: Design Practice
ART 013	Sculpture I
ARCH 034	Digital Drawing and 3D Modeling
ARCH 043	Architectural Design I

Architecture Courses

ARCH 002 History of Architecture 4 Credits
Survey of architecture from the Renaissance to the present, examined in the context of culture formation, design concepts, and the built environment.
Attribute/Distribution: HE, HU

ARCH 010 (CEE 010) Engineering/Architectural Graphics and Design 0,3 Credits
Graphical communication of civil engineering or architectural projects using manual techniques and commercial state-of-the-art computer software. Topics include visualization and sketching; orthographic, isometric and other drawings; points, lines and planes in descriptive geometry; site design; overview of geographical information systems and 3D applications. Teamwork on design projects with oral and graphical presentations. Open to a limited number of architecture, design arts or other students with project roles consistent with students' background. Not available to students who have taken MECH 10.
Attribute/Distribution: AL

ARCH 034 Digital Drawing and 3D Modeling 4 Credits
In our increasingly visual world we often need to present ideas in realistic, expressive, and engaging ways. This introductory course presents the basics of digital drawing and rendering through the lens of architecture, but is intended for students of all disciplines interested in visual communication. This project-based course focuses on the essentials of AutoCAD, SketchUp, and Revit supplemented with V-Ray and Photoshop for rendering.
Attribute/Distribution: AL, HU

ARCH 043 Architectural Design I 4 Credits
Fundamental design studio for architecture majors. Composition, spatial concepts; precedent; materials and detail; light and color in architecture. Instruction in basic communication techniques.
Prerequisites: ART 004 or ARCH 034
Can be taken Concurrently: ART 004, ARCH 034
Attribute/Distribution: AL, HU

ARCH 071 Special Topics in Architecture 1-4 Credits
Directed projects for students in architecture. Student must initiate contact with sponsoring professor. Permission of Instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 123 Visualization and Fabrication in Architecture 4 Credits
This course concentrates on visualization and fabrication in architecture. Students are introduced to advanced architectural diagramming and model-making as well as conventional and digital representation skills. This course investigates architectural graphics as an active means of communication and as a generative element in organizing architectural space. Precedents and examples are extensively researched. All exercises are designed to enhance students' ability to imagine and visualize complex architectural forms and spaces. Various architectural materials are employed and tested.
Attribute/Distribution: AL, HU

ARCH 126 (ART 126, THTR 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society.
Attribute/Distribution: CC, HE, HU

ARCH 143 Architectural Design II 4 Credits
Studio format, introductory course in architectural design which introduces students to new ways of thinking about architecture and the perception of space, three-dimensional composition, drawing, and model-making.
Prerequisites: ARCH 043
Attribute/Distribution: HU

ARCH 157 Architectural Technology I 4 Credits
The two-course sequence (ARCH 157 & ARCH 158) introduces the use of building materials, components and systems (slabs, walls, trusses, facade systems, etc.) while providing students with the knowledge to design and construct comfortable, technically sound and aesthetically pleasing buildings. Recommended to be taken concurrently with ARCH 143.
Attribute/Distribution: CC, HU, Q

ARCH 158 Architectural Technology II 4 Credits
The two-course sequence (ARCH 157 & ARCH 158) introduces the use of building materials, components and systems (slabs, walls, trusses, facade systems, etc.) while providing students with the knowledge to design and construct comfortable, technically sound and aesthetically pleasing buildings. Recommended to be taken concurrently with ARCH 243.
Attribute/Distribution: CC, HU, Q

ARCH 159 Modern History and Sustainable Architecture in Munich 3 Credits
This Lehigh faculty-led study abroad program allows students from an array of majors to earn three credits over winter break. The program will explore the history, culture, and architecture of Munich, a capital and center of the southern state of Germany, Bavaria. The program of study does not require German language skills. Fulfills an history/theory elective requirement for the BA in Architecture major.
Attribute/Distribution: AL, CC, HU

ARCH 171 Special Topics in Architecture 1-4 Credits
Directed projects for students in architecture. Student must initiate contact with sponsoring professor. Must have major standing in department and/or consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 176 (ANTH 176, ART 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ARCH 184 (GS 184, HIST 184) Paris: The Global City 3 Credits
An overview of the development of the city of Paris from its origins as an outpost on the far reaches of the Roman Empire to its rise as capital of medieval Christendom, from seat of Absolute Monarchy to birthplace of modern revolutions, resistance and occupation in the era of world wars, and model of modern urban planning in the 19th, 20th and 21st centuries. Focus is on the way global contexts shaped social and political life at the local level.
Attribute/Distribution: CC, HE, HU

ARCH 210 20th Century Architecture 4 Credits
History and theories of modern and contemporary architecture. Analysis of buildings, architects, theories and manifestos from the early 20th century to the present.
Prerequisites: ART 001
Attribute/Distribution: HU, W

ARCH 211 Architectural Drawing/Analysis and Expressions 3 Credits
This studio course is part of the Lehigh in Italy summer program and will utilize several different architectural drawing techniques to study aspects of architecture from analysis of a piazza to architecture in detail. It will employ pencil sketching, charcoal drawing, and watercolor. These drawings will act as a way of seeing the Italian urban landscape and supplement the study and analysis of the Italian architects' contemporary work. Fulfills an art studio elective requirement.
Attribute/Distribution: AL, HU

ARCH 243 Architectural Design III 4 Credits
Design principles of space and form and issues of “materiality,” “structure,” “modes of representation” and the “process of making.”
Prerequisites: ARCH 143
Attribute/Distribution: HU

ARCH 271 Special Topics in Architecture 1-4 Credits
Directed projects for advanced students in architecture or architectural criticism. Must have major standing in the department or permission of the instructor. Student must contact sponsoring professor and complete a contract sheet at preregistration.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, Q, W

ARCH 300 Apprentice Teaching 1-4 Credits
Supervised participation in various aspects of the teaching of a course. Transcript will identify department in which apprentice teaching was performed. Consent of department chair required. The transcript will reflect the subject area in which the teaching was done.
Repeat Status: Course may be repeated.

ARCH 311 Architectural Portfolio 4 Credits
The course will aid students in the concept, layout, and preparation of a portfolio for graduate school application or employment search. Graphic techniques and reproduction methods will be emphasized via software workshops and weekly feedback. Recommended to be taken with ARCH 343. Non-architecture majors interested in taking the course should contact the instructor.
Repeat Status: Course may be repeated.
Prerequisites: ARCH 243
Can be taken Concurrently: ARCH 243
Attribute/Distribution: HU

ARCH 335 Issues in Contemporary Architecture 4 Credits
Seminar on selective architectural topics from the 1960s to the present. Analysis of important architectural projects and theories. Interaction among architecture and social, economic, political and technological changes.
Prerequisites: ART 001 and ARCH 002
Attribute/Distribution: HU

ARCH 342 Theory of Form and Materials 4 Credits
Study of the genesis of form, its representation and its interrelationship to related artistic disciplines. Formal notions will be studied, compared and manipulated through the role of time, scale, perceptual analysis and material transformation. Consent of instructor required.
Attribute/Distribution: HU

ARCH 343 Architectural Design IV 4 Credits
The design of buildings and building groups, with the emphasis on urban design and the city.
Prerequisites: ARCH 143
Attribute/Distribution: HU

ARCH 389 Honors Project 1-8 Credits
Opportunity for undergraduate majors in Architecture to pursue an extended project for departmental honors. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q, W

Art Courses

ART 001 Art and Architecture History: Ancient to Medieval 4 Credits
Survey of art and architecture around the globe, from the world's earliest artistic and architectural production through the 14th century. European, Middle Eastern, African, Asian and Central and South American works are covered. The course also serves as an introduction to the vocabulary, concepts, and methods of art and architectural history.
Attribute/Distribution: HE, HU

ART 002 Art History: Renaissance to Present 4 Credits
Survey of art and architecture from the Renaissance through the contemporary era. Examining developments in painting, sculpture, and the built environment, as well as the rise of media such as printmaking and photography, the course explores the changing form and status of the visual arts in modern culture and society.
Attribute/Distribution: HE, HU

ART 003 Two-Dimensional Design 4 Credits
This class will present the fundamentals of two-dimensional design through the use of creative assignments and critical discussion. Using both traditional and digital media, students will gain an understanding of the design process and compositional theory with an introduction to the basic principles and elements of design.
Attribute/Distribution: AL, HU

ART 004 Three-Dimensional Design 4 Credits
An introduction to the basic elements and principles of design. involves use of various materials to solve 3D design problems in studio and computer lab. Problem solving in variety of materials for 3D design including assemblages, models, constructions, and conceptual forms. Required for all majors in department.
Attribute/Distribution: AL, HU

ART 007 (FILM 007) Digital Photography I 4 Credits
Intensive work in photography as fine art using digital input and output. Lectures, demonstratons, critiques.
Attribute/Distribution: AL, HU

ART 011 Drawing I 4 Credits
Concepts and practice of drawing, both traditional and contemporary. Includes drawing from life and an introduction to materials and techniques.
Attribute/Distribution: AL, HU

ART 013 Sculpture I 4 Credits
Projects directed toward developing design in sculpture. Exploration of materials and their application. Emphasis on sculptural form as it relates to techniques.
Attribute/Distribution: AL, HU

ART 015 Figure I 4 Credits
Drawing and modeling in clay from direct observation of the human figure. Fundamental principles of drawing, and two- and three-dimensional design through analysis of the human form. Inclass exercises cover basic scale, proportion, structure, drawing media and techniques, and clay modeling. Emphasis on personal expression, the human figure as vehicle for narrative, abstract or formal drawings or sculpture.
Attribute/Distribution: AL, HU

ART 034 Plein Air Painting I 4 Credits
Through weekly field trips to local sites, this class will provide the foundation for creating artwork in various media while exploring the exciting and unpredictable subject of the landscape. Although materials and techniques for painting in the outdoors will be covered, the primary objective of the course will be the introduction to heightened experience in nature through observation and response. Moderate hiking will be required for some field trips.
Attribute/Distribution: AL, HU

ART 035 Painting I 4 Credits
Painting in oil beginning with color mixing and basic layering techniques. Students learn the basic mechanisms for creative expression. Emphasis on understanding the physical nature of the materials.
Prerequisites: ART 003 or ART 011
Attribute/Distribution: AL, HU

ART 037 Printmaking I 4 Credits
An introduction to the fundamentals of printmaking. Students will gain an understanding of the technical processes and the visual language of different printmaking techniques. They will also examine historical approaches and context while exploring contemporary modes of expression.
Attribute/Distribution: AL, HU

ART 052 (FILM 052) Introduction to Video Recording and Editing 4 Credits
We will consider the interaction of image, sequence, motion, time and audio with video to create associative,abstract, documentary and narrative videos. Workshops in camera use, editing, concept development, lighting,sound and DVD authoring.
Attribute/Distribution: AL, HU

ART 069 Special Topics in Art History 1-4 Credits
Directed projects for students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HE, HU, W

ART 073 Introductory Studio Practice 1-4 Credits
An introduction to the methods and techniques of studio art. Designed to acquaint the student with general studio practice, covering topics not covered in other specific studio course listings.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

ART 077 The Laws of Light 3 Credits
In this course students will learn the laws of light and how to apply them to situations inside the studio and out. Course starts by exploring the physics of light through in class demonstrations. Then we will use different light sources and modifiers to experiment with a wide range of lighting scenarios. We will also focus on problem solving on set, as it is vital to understand what must be achieved in camera and what can be added in Photoshop.
Attribute/Distribution: AL, HU

ART 107 (FILM 107) Digital Photography II 4 Credits
An opportunity to produce a unified body of work and to explore digital photography on a deeper level with an opportunity to produce a unified body of work and to explore digital photography on a deeper level with an emphasis on conceptually driven images. Experimental process encouraged.
Prerequisites: ART 007 or FILM 007
Attribute/Distribution: HU

ART 111 Drawing II 4 Credits
Projects in creative drawing designed to build on concepts and practices initiated in basic drawing and life drawing.
Prerequisites: ART 011
Attribute/Distribution: HU

ART 113 Sculpture II 4 Credits
Development of principles and techniques in Sculpture I. Modeling, casting, fabrication and carving. Emphasizes an approach to sculptural form and an exploration of the evolution of modern sculpture.
Prerequisites: ART 013
Attribute/Distribution: HU

ART 115 Figure II 4 Credits
Projects in figure modeling and drawing from direct observation of the human figure, designed to build on concepts and practices initiated in Figure I. Students may elect to concentrate in one particular medium, although the primary investigation of form will always incorporate both two and three dimensional work.
Prerequisites: ART 015
Attribute/Distribution: HU

ART 121 (WGSS 121) Women in Art 4 Credits
A history of women artists from Renaissance to present day, with emphasis on artists of the 20th and 21st century from a global perspective. We explore attitudes toward women artists and their work as well as the changing role of women in art world. There may be required visits to museums and/or artists' studios.
Attribute/Distribution: CC, HE, HU

ART 124 (AAS 124, GS 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the AnteBellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santería), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

ART 125 (AAS 125, GS 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

ART 126 (ARCH 126, THTR 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society.
Attribute/Distribution: CC, HE, HU

ART 127 History of Photography 4 Credits
An overview of the history of photography and its theoretical debates since the inception of the medium in the early 19th century through the present. Combining lectures, on-site analysis of works from the Lehigh University Art Galleries, guest speakers, and exhibition visits, students will explore themes including the function of photographs in different historical and cultural contexts; photography's relation to fiction, truth, ethics, and aesthetics; and the role of materials, techniques, and reproduction in the creation of meaning.
Attribute/Distribution: CC, HE, HU

ART 131 (MUS 131) Music and the Creative Arts 3 Credits
This course examines collaborations, convergences and cross-influences between musicians, visual artists and other creatives in late 19th-early 20th century Europe and America. Students explore ways artists responded as individuals and collaborators, gain perspective on aesthetic movements including romanticism, realism, impressionism, symbolism, expressionism, futurism, dada, surrealism, and how these movements shaped the development of modernist culture. Students work with materials in the Music Department and LU Art Galleries teaching collection, studying the connections between music and visual works.
Attribute/Distribution: CC, HE, HU, W

ART 134 Plein Air Painting II 4 Credits
A sustained exploration of advanced plein air painting practices focusing on various media and approaches.
Prerequisites: ART 034
Attribute/Distribution: HU

ART 135 Painting II 4 Credits
A sustained exploration of paint media. Students concentrate on developing a body of related images using various media and approaches.
Prerequisites: ART 035
Attribute/Distribution: HU

ART 137 Printmaking II 4 Credits
Building on skills and concepts developed in Printmaking I. Individual projects in intaglio and relief and silkscreen with an emphasis on concept and refinement of image. Students concentrate on developing a body of related images using various media and approaches, furthering their research into historical approaches and context while exploring contemporary modes of expression.
Prerequisites: ART 037
Attribute/Distribution: HU

ART 169 Special Topics in Art History 1-4 Credits
Directed projects for students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HE, HU, W

ART 173 Special Topics in Studio Practice 1-4 Credits
Directed projects in art. Permission of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HE, HU, W

ART 175 Introduction to Museums and Museum Professions 4 Credits
Museums preserve and interpret cultural and natural heritage for the benefit of the public, but are also complex networks of professionals whose common goal is to create knowledge, share information, and connect with their communities. Students will gain an understanding of museum origins and histories, followed by an introduction to the wide range of museum professions such as curatorial, education, collections management, conservation, exhibition design, and administration. Recommended (but not required) as the introductory course for the Museum Studies minor.
Attribute/Distribution: CC, HE, HU

ART 176 (ANTH 176, ARCH 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ART 183 (GS 183, HIST 183) France from Medieval to Modern:Soc., Pol. & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: CC, HE, HU

ART 213 Advanced Sculpture Workshop 4 Credits
An advanced studio emphasizing sculpture within a contemporary context. Through the exploration of various concepts, material processes and rigorous critique, the student works toward developing their own unique vision and practice.
Repeat Status: Course may be repeated.
Prerequisites: ART 013 and (DES 004 or ART 004)
Attribute/Distribution: HU

ART 215 Advanced Figure Workshop 4 Credits
Further exploration of the human figure as the subject of art. More advanced students may elect to concentrate in either two or three dimensional representations in any media. The emphasis will be on personal interpretation and independent work with the instructor.
Prerequisites: ART 115
Attribute/Distribution: HU

ART 217 Advanced Studio Workshop 4 Credits
Studio Workshop is available to any student who has completed a second level discipline specific art studio such as Drawing II, Figure II, Painting II, Plein Air II, Digital Photography II, Printmaking II or Sculpture II and is designed for intermediate to advanced work in a specified medium. Course may be repeated.
Repeat Status: Course may be repeated.
Prerequisites: ART 111 or ART 107 or ART 113 or ART 115 or ART 135 or ART 152 or ART 134 or ART 137
Attribute/Distribution: HU

ART 220 Modern Art of the 20th Century 4 Credits
What was modern art, and how do we make sense of it? Modern artists revolutionized the art world of the 20th century, exploding its boundaries and conventions in ways that still challenge us today. This course explores modern art's origins and development. It offers a closer look at the leading artists, works, and debates of the period, and an introduction to the methods we use to understand and interpret them. Includes museum visits.
Attribute/Distribution: HE, HU, W

ART 221 (GS 221) Global Contemporary Art 4 Credits
Examines art and theory since World War II through the present in the global context. Topics include the development of abstract expressionism; conceptual art and the aesthetics of 1960s-era social movements; the politics of multiculturalism; the shift from contemporary to global in the 1990s; the rise of art biennials and the role of curators; post-Marxist and decolonial approaches to the arts; critical discourses on globalization; and issues of memory, trauma, migration, diaspora, and the environment. Includes museum and gallery visits.
Attribute/Distribution: CC, HE, HU, W

ART 222 Seminar in Art History 4 Credits
In this seminar students undertake sustained and focused study of select themes and topics from the history of art. Particular attention is devoted to learning the methods, theories, and research practices that art historians use to interpret and understand art. Seminar topics change annually.
Repeat Status: Course may be repeated.
Prerequisites: ART 002 or ART 001
Attribute/Distribution: HU

ART 223 Writing Your Way Into the Arts 3 Credits
A seminar course designed to build proficiency in the writing of personal statements, application materials, and portfolio narratives for students who are considering careers, internships, and graduate studies in the visual, performing, and creative arts or related fields. Specifically useful for juniors and seniors preparing for future opportunities after graduation. Writing intensive.
Attribute/Distribution: AL, HU, W

ART 227 (LAS 227) Latin American Art 4 Credits
Presents an overview of the origins and development of Latin American art since the independence period in the 19th century through the present. Understanding "Latin" American as a cultural construct that extends from Mexico to Tierra del Fuego and includes the Caribbean and Latinx cultures of the United States, the course examines key art movements and discourses across the region through the lens of historical and political events. Includes museum and gallery visits.
Attribute/Distribution: CC, HE, HU, W

ART 234 Advanced Plein Air Painting Workshop 4 Credits
An advanced studio emphasizing the development of a collective body of work as the student works toward developing their own unique vision and practice.
Repeat Status: Course may be repeated.
Prerequisites: ART 134
Attribute/Distribution: HU

ART 247 (FILM 247) Advanced Photography Workshop 4 Credits
Building on skills and concepts developed in Photography I and II, students will further their exploration of lens-based media and photo-based materials and processes, and the development of visual language in a structured environment. Through rigorous critique students develop their own voice, style and practice, building advanced digital and print bodies of work for professional review. Prerequisite: Art 107.
Prerequisites: ART 107 or FILM 107
Attribute/Distribution: HU

ART 269 Special Topics in Art History 1-4 Credits
ART 269. Special Topics in Art History (1-4) Directed projects for advanced students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ART 273 Special Topics in Studio Practice 1-4 Credits
Individually directed projects for advanced students capable of undertaking independent creative work in studio art. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ART 275 Museum Collections and Exhibitions 4 Credits
Museums often consider their collections as “core” to their work, and even their reason for existence. But how do museums move beyond simply being “object warehouses” and activate their collections to create public value? This course analyzes how museums care for, manage, and present their collections to the public through a range of formats, including exhibitions. Students will engage in hands-on learning and will contribute to a project at the Lehigh University Art Galleries (LUAG).
Attribute/Distribution: CC, HE, HU

ART 276 Museum Education and Interpretation 4 Credits
Museum collections can remain remarkably silent unless they are activated by skilled professionals charged with facilitating connections between objects and people. In this course, students investigate the critical role of museum educators, from gallery teaching to program development. Students will also explore other interpretive areas of museum work, from exhibition texts and labels to digital media and audio guides. Student will have the opportunity to teach with objects for the public at the Lehigh University Art Galleries (LUAG).
Attribute/Distribution: CC, HE, HU

ART 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ART 317 Departmental Capstone 4 Credits
Departmental Capstone is offered to seniors and qualified juniors and is taught collectively by the departmental faculty. Students focus on understanding and articulating their own interests and vision through research, written work, creation of new works of art, and critique. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ART 350 Special Topics in Graphic Design and Theory Seminar 1-4 Credits
Current topics in graphic communication theory and practice. will cover preparation, production, and formulation of individual portfolio. Selected readings and discussions in professional ethics as well as legal issues in the field will be covered.
Repeat Status: Course may be repeated.
Prerequisites: ART 253 or DES 253
Attribute/Distribution: ND

ART 356 Advanced Seminar in Art History 4 Credits
In this upper level seminar, students undertake advanced study of select themes and topics from the history of art. Special emphasis is accorded to the practical application of art historical methods, theories, and research practices. Students pursue advanced research projects related to the seminar topic, which changes annually.
Prerequisites: ART 001 and ART 002 and ART 220
Attribute/Distribution: HU

ART 370 Special Topics in Museum Studies 1-4 Credits
Special topics related to museum studies. Directed projects in museum and exhibition related fields. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ART 373 Studio Art Internship 1-4 Credits
Practical infield experience in an artist's studio or art-related apprenticeship opportunity. Requires approval a semester in advance by instructor and host organization.
Attribute/Distribution: ND

ART 375 Museum Internship 1-4 Credits
Internship under professional supervision in all areas of museums and/or related organizations, regionally, nationally or abroad in well established or accredited institutions. Students must initiate contact/application. A contractual agreement or letter of acceptance is required. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ART 389 Honors Project 1-8 Credits
Opportunity for undergraduate majors in Art to pursue a project for departmental honors. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

Design Courses

DES 025 (THTR 025) Costume Construction I 0,2 Credits
Introduction to the art of costume construction. Costume construction materials, techniques, tools and safety. Practical experience in executing costumes for the stage.
Attribute/Distribution: AL, HU, Q

DES 026 (THTR 026) Costume Construction II 0,2 Credits
Continuation of THTR 25 - Costume Construction I, including pattern drafting, fitting, crafts and accessories. Materials, methods and problem solving. Practical experience in executing costumes for the stage.
Attribute/Distribution: AL, HU, Q

DES 040 Product Design I: Form, Process and Concept 4 Credits
Introduction to the field of Industrial Design. Through research, analysis, drawing and prototyping, students will acquire an understanding of the various aesthetic, technological, and business issues a designer must consider when creating a product.
Prerequisites: ART 004
Attribute/Distribution: AL, CC, HU

DES 053 Introduction to Graphic Design 4 Credits
This course serves as an introduction to the graphic design process, with a primary focus on concept development and craft. Students examine how to identify and resolve visual problems and learn the basics of design and typography. Creative solutions will be encouraged for projects with practical applications. Topics include logo development and execution, professional typography, image basics and resolution, print production, studio skills and professional practices. Digital applications include Photoshop, Illustrator and In-design.
Prerequisites: ART 003
Attribute/Distribution: AL, HU

DES 066 Design History 4 Credits
History of product design, graphic design and time-based media in artistic, cultural, technological, and business contexts.
Attribute/Distribution: HE, HU, W

DES 070 Web Design I 4 Credits
Introduction to the design and fabrication of web pages. Students will learn how to create pages using HTML and web fabrication software, with an emphasis on aesthetic and structure.
Prerequisites: ART 003
Attribute/Distribution: AL, HU

DES 072 (THTR 072) Textile Design I 4 Credits
Textile printing has brought about revolutionary changes in textile design. Textile Design utilizes digital photography, scanning, drawing and image editing software to create botanical and geometric patterns for textiles.
Attribute/Distribution: AL, HU

DES 073 Special Topics in Design 1-4 Credits
An introduction to methods and techniques of design studio. Designed to acquaint the student with general design elements, covering topics not covered in other specific studio course listings. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU, W

DES 079 (ASIA 079) Digital Bridges 2 Credits
Run as an independent study: research ancient Chinese bridges, gardens, and pavilions. Digitize images and website design. Create photographic documentation of the Bridge Project. Produce documentary from historical materials concerning history of Chinese students at Lehigh. Bridge Project students could continue project work in Shanghai and Beijing.
Repeat Status: Course may be repeated.

DES 080 Motion Graphics 4 Credits
Motion graphics takes art and design elements: shapes, objects, photographs, type and gives them movement. We explore effects techniques applied to stills, graphics and short video and work with abstract transformations in time. Prerequisite: Art 003 or permission of the instructor.
Prerequisites: ART 003
Attribute/Distribution: AL, HU

DES 087 (THTR 087) Performance Design 4 Credits
Introduction to the process of creating integrated designs in theatre production. The study and practice of the principles of visual representation, historical and conceptual research and the study of theatrical styles.
Attribute/Distribution: AL, CC, HU

DES 088 (THTR 088) Digital Rendering 4 Credits
Explore the use of modern technology to develop and communicate design ideas with speed, clarity, and visual punch. Strategies geared toward increasing the young designer's confidence in presenting artistic concepts. Learn the basics of Photoshop and SketchUp and then apply those skills in creative execution of scenic, costume, and lighting renderings.
Attribute/Distribution: AL, HU

DES 089 (THTR 089) Introduction to Fashion Design 4 Credits
An introduction to conceptual garment design. Research, devise, and develop collections of apparel and accessories. Basic elements of design, fashion theory, design processes, and rendering techniques.
Attribute/Distribution: AL, CC, HU

DES 111 (THTR 111) Sound Design 2 Credits
Introduction to the study of the techniques and equipment used for theatrical sound design. Elements include audio theory, script analysis, field recording and editing audio in digital audio workstations.
Attribute/Distribution: AL, HU

DES 129 (THTR 129, WGSS 129) History of Fashion and Style 4 Credits
Global trends in dress and culture from pre-history to today. The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: CC, HE, HU

DES 140 Product Design II: Designing for Others 4 Credits
This course will expose students to client based projects and issues of branding relevant to the product designer. Special emphasis will be given to functionality from a user centered perspective. Projects will also include the use of 3D digital prototyping software and computer based fabrication techniques.
Prerequisites: DES 040
Attribute/Distribution: HU

DES 148 Furniture Design I 4 Credits
Design methodology, fabrication techniques, and methods of design presentation.
Attribute/Distribution: AL, HU

DES 153 Graphic Design: Word and Image 4 Credits
This course explores techniques of image making in relation to analyzing and creating meaning in graphic and typographic messages. Students solve visual communication problems with visual, conceptual and social impact. Assignments may include book covers, posters, music packaging, and promotional materials. Students will work in both traditional and digital media.
Prerequisites: ART 053 or DES 053
Attribute/Distribution: HU

DES 154 (THTR 154) Scene Painting 4 Credits
Study and practice of basic and advanced methods of painting for the theatre. Includes basic elements and principles of design, color theory, the influence of light, atmosphere and aesthetics for the theatre.
Attribute/Distribution: AL, HU

DES 155 (THTR 155) Model Building and Rendering 4 Credits
The art and practice of model building and rendering for the stage. Special techniques including scale furniture, soldering, acrylic painting and hand drafting.
Attribute/Distribution: AL

DES 164 Ergonomics 4 Credits
Introduction to physical, emotional, and psychological ways design interacts with people. Analyze real design problems and create solutions.
Attribute/Distribution: HU

DES 170 Web Design II 4 Credits
Creation of dynamic content in web design. Various 2D animation software applications and simple scripting will be explored.
Prerequisites: DES 070
Attribute/Distribution: HU

DES 172 (THTR 172) Textile Design II 4 Credits
Building on skills and concepts developed in Textile Design I, students will develop their own voice in textile, apparel and accessory design.
Prerequisites: DES 072 or THTR 072
Attribute/Distribution: HU

DES 173 Special Topics in Design 1-4 Credits
Directed projects in design with selected readings as required. Student must initiate contact with sponsoring professor. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU, W

DES 186 (THTR 186) Lighting Design 4 Credits
An introduction to the art and practice of lighting design for the theatre. Script analysis, research, and the interplay of lighting technology and design. Students will develop a sense of the dramatic while creating a portfolio of lighting designs.
Attribute/Distribution: AL, CC, HU

DES 188 (THTR 188) Scenic Design 4 Credits
An introduction to the art and practice of scenic design for the theatre. Script analysis, research, drafting and modeling techniques. Students will develop a sense of the dramatic while creating a portfolio of scenic designs.
Attribute/Distribution: AL, CC, HU

DES 189 (THTR 189) Costume Design 4 Credits
An introduction to the art and practice of costume design for the theatre. Script analysis, research, and rendering techniques. Students will develop a sense of the dramatic while creating a portfolio of costume designs.
Attribute/Distribution: AL, CC, HU

DES 240 Product Design III: Materials to Market 4 Credits
In this advanced level studio students will research fabrication techniques and materials, develop ideas into prototypes, outsource production and sell their designs in a competitive retail market. This course confronts the financial realities of being an independent designer while offering an opportunity to create innovative and desirable domestic products.
Prerequisites: DES 040
Attribute/Distribution: HU

DES 248 Furniture Design II 4 Credits
Advanced fabrication. Contemporary art issues and furniture history.
Repeat Status: Course may be repeated.
Prerequisites: DES 148
Attribute/Distribution: HU

DES 253 Graphic Design: Brand Experience 4 Credits
Students examine the basic principles of corporate identity and develop a clear understanding of the process of creating brands. Projects will offer a framework for looking at business strategy as it relates to the creative process of design. Emphasis will be placed on creating visual elements that support a brand and the steps a designer takes to create a consistent brand. In addition, students will develop self-promotion materials and identity systems.
Prerequisites: DES 153
Attribute/Distribution: HU

DES 268 Advanced Design Projects 1-4 Credits
Advanced projects or studies applying Design Arts practices or theories. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

DES 272 (THTR 272) Advanced Textile Design Workshop 4 Credits
Building on skills and concepts developed in Digital Textile Design II, students work towards a maturing studio practice within an atmosphere of rigorous critique. Further exploration in the conceptual research and material tools of surface design in textiles developed in DES 072 and 172, with experimentation in broader media is encouraged. An expansion of knowledge of textiles and apparel in the 21st Century will inform the development of a design practice and portfolio. Prerequisite: DES 172 / THTR 172.
Repeat Status: Course may be repeated.
Prerequisites: DES 172 or THTR 172
Attribute/Distribution: HU

DES 300 Apprentice Teaching 1-4 Credits

DES 311 Design Portfolio 1-4 Credits
The concept, layout, and preparation of a portfolio for graduate school application or employment search, including graphic techniques and reproduction method. Student must contact sponsoring professor.
Repeat Status: Course may be repeated.
Prerequisites: DES 240 or DES 253

DES 348 Furniture Design III 4 Credits
Advanced fabrication, contemporary art issues and furniture history.
Prerequisites: DES 248
Attribute/Distribution: HU

DES 370 Special Topics in Design 1-4 Credits
Current topics in design, with selected readings, discussions, and studio work as required. Must have completed two 100-level Design courses. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

DES 375 Design Internship 1-4 Credits
Practical experience following apprenticeship model. Requires approval of instructor and host prior to beginning of the term, with a memorandum of understanding outlining student work responsibilities and educational objectives for the experience.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

DES 385 Fusion: Design Practice 1-4 Credits
Fusion: Design Practice is a project-based studio that offers students the opportunity to harness the skills they learn in the classroom for real-world application, as important tools for inquiry, dialogue, and service in the community and world at large. Projects prioritize experiential learning in architectural, graphic, and product design, and related fields. Fusion students see design projects through from beginning to end, from research and design to construction and production, frequently working in collaboration with university and community partners.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

DES 389 Honors Project 1-8 Credits
Opportunity for undergraduate majors in Design to pursue a project for departmental honors. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

Asian Studies

Website:http://asia.cas **(**http://asia.cas2.lehigh.edu/**)**.lehigh.edu/ **(**http://asia.cas2.lehigh.edu/**)**

The Asian and Asian American Studies Program at Lehigh offers an interdisciplinary home for the study of Asia. Drawing on our faculty strengths across a wide range of humanities and social science fields, the program focuses on the major cultural areas of East Asia, Southeast Asia, South Asia, and the Himalayan region, exploring histories, languages, religions, societies, politics, literature, the arts, and media, past and present. In their research and teaching, our program faculty expand understanding of Asian societies in global context, and deepen awareness of Asian and Asian American histories and experiences within the United States. The Asian and Asian American Studies Program gives undergraduates in any college within Lehigh an opportunity to study the dynamic and rich cultural heritages of Asian societies, and to understand their impact on the past, present, and future of our world. Students have the option of choosing to minor or major in Asian Studies. The Asian and Asian American Studies program requirements are designed to make it easy for students to combine a minor or a double major in Asian and Asian American Studies with other programs at Lehigh. Coursework in Asian and Asian American Studies enhances student preparation for a range of careers, in fields including business and finance, health, journalism, media, international relations, politics, environmental sciences, literature, the arts, and engineering.

MAJOR IN ASIAN AND ASIAN AMERICAN STUDIES

The Bachelor of Arts major in Asian and Asian American Studies offers students the choice of a standard or honors track. The standard major requires a minimum of 32 credits. The Honors track requires a minimum of 35 credits. All students must reach Intermediate II level in an Asian language, participate in an Asian International Experience, and complete courses in categories **A to D** as listed below. The academic advisor is the director of the Asian and Asian American Studies Program. Students may also request an advisor from among the Asian and Asian American Studies faculty.

Asian & Asian American Studies, BA

A. One Foundational Core Course

Students choose 1 course from the Foundational Core courses. Foundational Core courses introduce students to the study of Asian Societies: [1]		4
REL/ASIA 012	Mountains, Buddhas, Ancestors: Introduction to East Asian Religions	
ASIA/IR 061	East Asian International Relations	
ASIA/MLL/HIST 075	Chinese Civilization	
ASIA 091	Special Topics (Intro to Asian Studies)	
ASIA/SOC 114	Social Issues in Contemporary China	
ANTH/ASIA/GS 187	Contemporary Southeast Asia	

B. Depth Concentration

Students choose 3-4 courses (12-16 credits) in Asian Humanities and Social Sciences.	12-16
C. Advanced Asian Studies Course [2]	
Students choose one advanced Asian Studies course at the 200 level or above. This may include an advanced Asian language course.	4
D. Asian Studies Electives [3]	
Students choose 1-2 additional elective courses (3-8 credits).	3-8
E. One Asian International Experience [4]	
Asian Studies majors are eligible for Asian Studies travel support if they participate in a Lehigh-approved program. After declaring the major, students will meet with the Study Abroad adviser to design their Asian International Experience. Students may also choose to take part of their Asian Studies course credits through Study Abroad.	3-4
F. Senior Capstone (credit load varies depending on whether student chooses Honors or standard track). [5]	
Pre-Capstone (2-4 credits in Fall); Capstone (2-4 credits in Spring)	4-8
Students are encouraged to build on earlier coursework to choose an option under supervision of a faculty member. Options include: a portfolio of revised Asian Studies coursework with a reflective essay (non-Honors); a traditional research thesis (Honors option only); or an internship or other special project (with Program Director permission).	
Minimum number of credits	**32**

1

An appropriate course may be substituted with approval of Program Director, including Big Questions Seminars, ASIA 090, or 091 and 092: Special Topics.

2

Courses in Chinese, Japanese or other Asian language may apply as program electives with approval of the Program Director.

3

In consult with the Asian Studies Director, students may choose from a wide variety of Asian Studies courses each semester. Other suitable courses, including but not limited to courses at LVAIC or other approved institutions in the United States or courses in approved study abroad programs in Asia may be substituted with the Director's approval.

4

If study abroad is difficult academically or financially, other arrangements can be made upon major advisor's approval.

5

Students may enroll in ASIA 399 twice for a total of 4-8 credits: first, to complete the pre-capstone requirement and again to complete the senior capstone project; or, an equivalent, appropriate sequence of capstone study approved by the program director.

MINOR IN ASIAN AND ASICAN AMERICAN STUDIES

The minor in Asian Studies is intended to complement a student's major field of study and it is flexible according to individual needs. Students are free to survey the field broadly or concentrate in a specific area such as Chinese or Japanese studies. The minor comprises a minimum of 4 courses (16 credits) in Asian studies, chosen from an approved list in consultation with the director of the Asian Studies Program.

While students minoring in Asian and Asian American Studies are encouraged to study languages, only 8 credits of language study count towards the Asian and Asian American Studies minor. Students interested only in language study are encouraged to minor in Chinese or Japanese language (see MLL (p. 209)).

CORE AND ELECTIVE COURSES

Each semester, a complete list of ASIA course offerings can be found on the Asian and Asian American Studies web site (https://asia.cas.lehigh.edu/) or in the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280. Other courses approved by the program director.

STUDY ABROAD PROGRAMS

Students are encouraged to spend a summer, semester, or year in an approved study program in China, Japan, Korea, Thailand, India, or elsewhere in Asia. Students who wish to study abroad, and who wish to have the academic work taken in that program count toward a Lehigh degree, must have a GPA of 2.7 or higher, or a 2.7 average over the last two regular (spring or fall) semesters. Any student with a lower GPA may petition the Committee on the Standing of Students for an exception to this rule before applying to an approved study abroad program. These programs are open to all LVAIC students subject to the regulations of their home institutions. For details on all programs, consult Study Abroad Office, Coxe Hall, 32 Sayre Dr, 610-758-3351, (www.lehigh.edu/studyabroad (http://www.lehigh.edu/studyabroad/)) **Asian and Asian American Studies offers a limited number of study abroad travel grants.**

Courses

ASIA 010 (PHIL 010, REL 010) Intro to Buddhism: Love Death and Freedom 4 Credits
This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism's Indian origins to its spread across Asia and globally. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and the forms of social and individual love and concern. Course materials include poetry, biographies, philosophical writings, art and film.
Attribute/Distribution: HE, HU

ASIA 012 (REL 012) Mountains, Buddhas, Ancestors: Introduction to East Asian Religions 4 Credits
This course explores the principal religions of East Asia, including Buddhism, Daoism, Confucianism, Shinto, and Shamanic Traditions. What is each tradition's view of human potential? How is ultimate reality depicted and experienced? What do home altars, boisterous festivals, and silent meditation halls have in common? Several primary texts are read in translation.
Attribute/Distribution: HE, HU

ASIA 050 (MLL 050, WGSS 050) Dreaming in Pre-modern China 4 Credits
Life is a cosmic allegory experienced by a group of all-too-human incarnated spirits of the 18th century novel Story of the Stone (aka Dream of the Red Chamber). A unique depiction on the inner emotional landscape of young women and the quest for identity by Precious Jade--is he a real boy? Read and discuss in English. Option to combine with CHIN 371 for those who wish to also read and research it in Chinese.
Attribute/Distribution: HE, HU, W

ASIA 053 (THTR 053) Bollywood Dance 2 Credits
Bollywood is a term compounded from "Bombay" (now Mumbai) and "Hollywood." Bollywood dance is the movement form used in Indian films - a unique and energetic style inspired by Indian folk dance and Indian classical dance, Middle Eastern, and modern dance. Explore how each of these unique styles combine to create modern Bollywood dance. Learn the fundamental movements, gestures, and expressions that create the Bollywood dance aesthetic, and how they are applied in choreographed sequences.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

ASIA 055 (THTR 055) Indian Classical Dance 2 Credits
Introduction to the history and practice of Bharatanatyam, a classical dance style of India. Understanding basic footwork, hand gestures, and body movements, and how they are combined to convey emotion, meaning, and imagery. Traditional repertoire, music, terminology, and the spectator's experience of the dance.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

ASIA 057 Globalization in Asia through Time and Space 4 Credits
Have you ever wondered about Asia? It covers a vast geographic territory; it is divided into East, South, and Southeast Asia and each sub-region contains numerous different ethnic groups, cultures and nations. The time span for these cultures is similarly vast going back to pre-history and continuing through modern times. The topics we investigate range from popular culture to technology, music, gender, languages, and so on. Students will have a chance to participate in hands-on experience sessions on these topics.
Attribute/Distribution: HE, HU

ASIA 060 (REL 060) Religions of South Asia 4 Credits
A thematic introduction to the foundational religious traditions of South Asia: Hinduism, Jainism, Buddhism, Sikhism and Islam. Students explore the social and spiritual dimensions of these religious worlds through scripture, ritual practices, narrative and teaching traditions, music and art.
Attribute/Distribution: HE, HU

ASIA 061 (IR 061) East Asian International Relations 4 Credits
Introduction to East Asian international relations, with emphasis on post-1945 period: historical background of Asian international system; Cold War conflicts; China's rise and regional responses; Japan's changing international role; the two Koreas; ASEAN and Asian regionalism; U.S. and Russian policies; current and future issues.
Attribute/Distribution: CC, SS, SW

ASIA 063 (IR 063) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Attribute/Distribution: CC, SS, SW

ASIA 066 (IR 066) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates.
Attribute/Distribution: SS, SW

ASIA 072 (MLL 072) Ghosts, Monsters, and J-Horror 4 Credits
What's behind our fascination with the ghost stories? What are some of the social issues that the horror stories examine? What makes us afraid? Examining Japan's long tradition of horror stories of ghosts and monsters, this course introduces students to various Japanese horror stories, ranging from the classical texts to "J-Horror," and explores how contemporary forms of popular culture such as anime, manga, and films draw on, or depart from, the traditional images of supernatural beings. No prerequisites. In English.
Attribute/Distribution: HE, HU, W

ASIA 074 (MLL 074) Chinese Cultural Program 1-8 Credits
A summer program in China, taught in English.
Attribute/Distribution: HE, HU

ASIA 075 (HIST 075, MLL 075) Chinese Civilization 4 Credits
This course reviews the evolution of Chinese culture from the Neolithic up to the end of the imperial age in 1911. While the framework is historical, students are exposed to all facets of what defines civilization, including social traditions, philosophy, religion, material culture, literature, art and architecture, military science, education, law, and institutional history. Students are encouraged to continue their study of China afterwards with the course on Modern Chinese Civilization.
Attribute/Distribution: CC, HE, HU, SS, W

ASIA 077 (GS 077, REL 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur'an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.
Attribute/Distribution: HE, HU, W

ASIA 078 (MLL 078) Asian-American Studies 4 Credits
A survey of issues concerning Asians living in the United States from the perspectives of history, language, literature, and film.
Attribute/Distribution: CC, HE, HU

ASIA 079 (DES 079) Digital Bridges 2 Credits
Run as an independent study; research ancient Chinese bridges, gardens, and pavilions. Digitize images and website design. Create photographic documentation of the Bridge Project. Produce documentary from historical materials concerning history of Chinese students at Lehigh. Bridge Project students could continue project work in Shanghai and Beijing.
Repeat Status: Course may be repeated.

ASIA 080 (HIST 080) In Search for Modern China 4 Credits
This course is designed as a survey history of modern China from the late Ming to the present. We will ask some important questions over the course of the semester. When does "modern" China begin? How do we approach modern Chinese history? What are the boundaries of China/Chinese identity? Could these concepts stretch to include the Chinese diaspora? How has Chinese imperial history affected contemporary China's state and society?
Attribute/Distribution: CC, HE, SS, W

ASIA 091 Special Topics 1-4 Credits
A topic, genre, or intensive, research-oriented study of a subject or issue in Asian Studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

ASIA 099 (ARAB 099, CHIN 099, FREN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Elementary language and culture abroad other than Chinese or Japanese.
Attribute/Distribution: AL, HU

ASIA 110 (MLL 110, REL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined.
Attribute/Distribution: HE, HU, W

ASIA 114 (SOC 114) Social Issues in Contemporary China 4 Credits
Dramatic Economic, cultural and social changes are underway in China today and have aroused much debate among social scientists East and West. The following social issues are critical for understanding China's development trajectory: inequality and poverty; rapid demographic shifts; provision of health care services; provision of education services; and becoming an "information society." We will explore how these issues intersect with old hierarchies in China, urban-rural differences, and gender differences.
Attribute/Distribution: SS

ASIA 115 (MLL 115, WGSS 115) Sex, War, Women, Art 4 Credits
Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary women artists, and writings on sex workers, impacted by the Japanese empire. Students will be exposed to feminist theories in this course; taking WGSS001 is recommended prior.
Attribute/Distribution: CC, HE, HU, W

ASIA 119 (GS 119, REL 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a "modern" religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.
Attribute/Distribution: CC, HE, HU, W

ASIA 130 (MLL 130, REL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment odyssey, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HE, HU, W

ASIA 135 (MLL 135, WGSS 135) POWER, (WO)MEN, SILENCE 4 Credits
What do women say in their writings when their voices are silenced? How does silence speak to you? How do gender, sexuality, class, and power articulate one another? Through the study of selected short stories, novels, films, and anime, this course examines various voices, cultures, histories, and societies in Japan. No prior knowledge of Japanese language is required. An introductory course taught in English.
Attribute/Distribution: HE, HU, W

ASIA 140 (PHIL 140) Eastern Philosophy 4 Credits
Survey of selected texts and issues in the eastern philosophical traditions. Attention will be given to the development and interrelations of these traditions as well as a comparison of western and eastern treatments of selected issues. Areas of focus may include Confucianism, Taoism, and Zen Buddhism.
Attribute/Distribution: HE, HU

ASIA 142 (PHIL 142) Zen and Art of the Everyday 4 Credits
The Japanese conception of beauty is strikingly different to our own: it is associated with impermanence, imperfection, and austerity. Moreover, attention to beauty pervades even everyday activities in Japan, such as wrapping purchases at the dollar store or putting out garbage. This course explores principles that guide the Japanese aesthetic sensibility with an eye to its expression in Japanese literature, film, and traditional arts, such as the tea ceremony and gardening.
Attribute/Distribution: HE, HU

ASIA 145 (GS 145, REL 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the changes and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: CC, HE, HU, W

ASIA 152 (GS 152, MLL 152) Chinese Literature in the World 4 Credits
What place does Chinese literature occupy in the world? In this course we will read and discuss important works of modern Chinese fiction and drama alongside critical and theoretical writings on world literature. Student papers will integrate these discussions to reflect on questions such as center/periphery, national form, and canon formation. The course objectives are to introduce students to current debates on the topic of world literature and to resplendent modern Chinese short stories, novellas, and plays. Taught in English.
Attribute/Distribution: CC, HU, W

ASIA 163 (IR 163) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. This is an advanced course on US-China relations. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: CC, SS

ASIA 164 (IR 164) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates. Students may not receive credit for both IR/ASIA 066 and IR/ASIA 164.
Prerequisites: IR 010 or IR 061 or IR 063
Attribute/Distribution: SS

ASIA 169 (REL 169) Enlightening Lives: Buddhist Auto/Biography in Asia and the US 4 Credits
How do Buddhists imagine a "good life"? Buddhist biographies, autobiographies, poems, paintings, and films from Asia and the US reveal how Buddhists describe an ideal human life, addressing love, art, war, religious awakening.
Attribute/Distribution: CC, HE, HU, W

ASIA 172 (REL 172) Tibetan Buddhism and Society 4 Credits
This course examines the history, rituals, practices and art of the Tibetan Buddhist world, and the interaction of Tibetan Buddhism with the Tibetan Bon religion and Tibetan Islam. Students will explore film, autobiography, visual arts, and religious writings, asking, How has Tibetan Buddhism shaped Tibetan societies, as well as neighboring cultures in East Asia and Inner Asia? In what ways is Tibetan Buddhism now a global religion?
Attribute/Distribution: HE, HU, W

ASIA 173 (REL 173, WGSS 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S..
Attribute/Distribution: CC, HE, HU, W

ASIA 186 (SOC 186) Understanding China through Films 4 Credits
We will use documentary and feature films to demonstrate how Chinese people experience and interpret social, political, economic and cultural changes. Through sociological interpretation of film, we will focus on education provision, migration, environmental concerns, gender relations, poverty, and changing cultural norms and values. We will explore how these social issues have been intensified with economic reform and how they intersect with major historical hierarchies in China.
Attribute/Distribution: CC, SS, SW

ASIA 187 (ANTH 187, GS 187) Contemporary Southeast Asia 4 Credits
Peoples and cultures of Burma, Laos, Cambodia, Thailand, Malaysia, Singapore, Indonesia, and the Philippines. World view, religion, economy, politics, and social organization.
Attribute/Distribution: CC, SS, SW

ASIA 191 Special Topics 1-4 Credits
A topic, genre, or intensive, research-oriented study of a subject or issue in Asian Studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

ASIA 199 (ARAB 199, CHIN 199, FREN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate language and culture abroad other than Chinese and Japanese.
Attribute/Distribution: HU

ASIA 201 (GS 201, POLS 201) South Asian Politics 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest.
Attribute/Distribution: CC, SS, SW

ASIA 213 (MUS 213) Drums and Gongs: Asian Musical Cultures 3 Credits
A study of Asian music history, theory, aesthetics, and cultures through hands-on performance workshops, lectures, and seminars.
Attribute/Distribution: HU

ASIA 220 (REL 220) Poet, Meditator, King: Classics of East Asian Religion 4 Credits
Classic texts of East Asia and an introduction to the traditions they represent. What do these texts teach about reality, humanity, divinity, virtue and society? How is the path of personal and social transformation presented?
Attribute/Distribution: HU

ASIA 221 (REL 221) Topics in Asian Religions 4 Credits
Selected thematic and comparative issues in different Asian religious traditions. May include Buddhism and Christianity, religion and martial arts, Asian religions in America, Taoist meditation, Zen and Japanese business, Buddhist ethics.
Repeat Status: Course may be repeated.

ASIA 240 (PHIL 240) Eastern Philosophy Seminar 4 Credits
Advanced seminar in Eastern Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

ASIA 247 (GS 247, REL 247) Islamic Mysticism 4 Credits
Sufism, the inner or 'mystical' dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition's impact on art and music, poetry and prose.
Attribute/Distribution: CC, HE, HU, W

ASIA 254 (ETH 254, EVST 254, REL 254) Buddhism and Ecology 4 Credits
Buddhism's intellectual, ethical, and spiritual resources are re-examined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: CC, HE, HU, W

ASIA 256 (HIST 256, MLL 256, WGSS 256) Women in Pre-Industrial China 4 Credits
This seminar focuses on the role of women as defined by medical, philosophical, legal, historical, religious, literary and other Chinese texts from ancient through early modern times. Attention is how women contributed to the evolution of traditional Chinese civilization and culture. The course materials are in English.
Attribute/Distribution: HE, HU, W

ASIA 257 (HIST 257, HMS 257, MLL 257) Traditional Chinese Medicine: Historical Perspectives 4 Credits
This seminar focuses on conceptions of the human body and health that evolved from the ancient through early modern times. Special attention is paid to healing strategies, the roles of healers and patients, and the evolution of a medical canon. The course materials are in English.
Attribute/Distribution: HE, HU, W

ASIA 291 Special Topics 1-4 Credits
A topic, genre, or intensive, research-oriented study of a subject or issue in Asian Studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

ASIA 299 (ARAB 299, CHIN 299, FREN 299, GERM 299, HEBR 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced language and culture abroad other than Chinese and Japanese.
Attribute/Distribution: HU

ASIA 339 (POLS 339) The Rise of the State in Modern East Asia 4 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.
Attribute/Distribution: SS

ASIA 343 (AAS 343, GS 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of "race" and its impact on domestic and international politics.
Attribute/Distribution: SS

ASIA 361 Internship in Asian Studies 1-4 Credits
Internship in public or private agency involved in some aspect of Asian studies. Individual faculty mentor. Written report required. Program permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

ASIA 364 (IR 364) Chinese Foreign Policy 4 Credits
Research-oriented seminar focusing on the sources of Chinese foreign policy preferences and goals, foreign policy decision-making processes, international implications of the rise of China, and the pressing regional and global issues that China is facing now and in the future. Students are strongly recommended to take at least one China/East Asia course before, or simultaneously with, IR364. Consent of department required.
Prerequisites: IR 010 or IR 061 or ASIA 061 or IR 062 or ASIA 062 or IR 063 or ASIA 063 or IR 161 or ASIA 161 or IR 163 or ASIA 163
Attribute/Distribution: CC, SS, W

ASIA 369 (GS 369, POLS 369, WGSS 369) Women's Movement in China 4 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, "did the Party liberate women?"
Attribute/Distribution: SS

ASIA 371 Advanced Readings in Asian Studies 1-4 Credits
Directed course of reading and writing in advanced topic not covered in regular Asian Studies course offerings. Program permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

ASIA 381 Senior Seminar in Asian Studies 1-4 Credits
Advanced seminar focusing on discussion and research on specialized subjects in Asian studies. Variable subject matter. Offered by faculty on rotating basis. Program permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

ASIA 386 Chinese Culture in a Multinational Workplace 3 Credits
Students explore the interaction between Chinese and non-Chinese cultures at a variety of work sites in the city of Shanghai, a port city that has involved people of many nationalities since its birth in the 1840s. This project-based course involves a faculty mentored practicum at one or more specific sites related to the student's own field or major, assigned readings, weekly electronic Course Site discussions, and a written summary of the experience.

ASIA 389 Honors Project 1-6 Credits
An opportunity for majors who want to undertake a project with the potential for program honors. Requires approval of program advisor.
Attribute/Distribution: CC, W

ASIA 391 Special Topics 1-4 Credits
A topic, genre, or intensive, research-oriented study of a subject or issue in Asian Studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

ASIA 399 Senior Thesis in Asian Studies 1-4 Credits
Advanced, individual research project on topic agreed between faculty and student. Research paper and oral defense required. Open to Asian studies majors only. Program permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

Astronomy and Astrophysics

Astronomy and Astrophysics are offered in the Department of Physics.

Astrophysicists apply physics and mathematics to the study of planets, stars, galaxies, pulsars, black holes, quasars and the universe, among many other fascinating objects in order to understand their origin, evolution and ultimate fate. Students who major in astronomy or astrophysics usually have very inquisitive minds and a good aptitude for physics and mathematics. The bachelor degree programs in astronomy and astrophysics provide the student with a solid background in laboratory and theoretical astrophysics as well as in the fundamentals of physics and mathematics. Research opportunities are available to supplement classroom instruction.

The bachelor of science degree in astrophysics is designed for students who wish to go on to graduate studies in astrophysics with the goal of becoming professional astronomers. Professional astronomers generally find positions at colleges, and universities, national labs, NASA or its contractors and in various space industries. This degree also prepares you for many jobs in related fields such as computer science, mathematics or physics.

The bachelor of arts degree in astronomy is intended for students who desire a broad background in astronomy, mathematics and physics but do not plan to do graduate work in astrophysics. With this broad background, the student is well prepared in many fields of endeavor, including planetarium and museum work, teaching astronomy at colleges and universities, secondary education, science writing, or in many professions in which the ability to learn is critical.

Both of these degrees can be profitably combined with mathematics and other sciences producing excellent double majors or double degrees.

A minor program in astronomy is also available for students who wish to enlarge their potential for a career choice or who may be eager to learn more about astrophysics than an introductory course can provide.

ASTRONOMY AND ASTROPHYSICS DEGREE PROGRAMS

B.A. with Major in Astronomy Program Requirements

Mathematics		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
Basic and Intermediate-Level Science		
ASTR 007 & ASTR 008	Introduction to Astronomy and Introduction to Astronomy Laboratory	4
EES 021	Dynamic Earth	3
PHY 010	General Physics I	4
or PHY 011	Introductory Physics I	
PHY 013	General Physics II	3-4
or PHY 021	Introductory Physics II	
PHY 012	Introductory Physics Laboratory I	1
PHY 022	Introductory Physics Laboratory II	1
PHY 031	Introduction to Modern Physics	3
ASTR 105	Introduction to Planetary Astronomy	3
PHY 220	Advanced Physics Laboratory I	3
Advanced Astronomy and Astrophysics		
ASTR 301	Introduction to Stellar Astrophysics	3
ASTR 302	Introduction to Galactic and Extragalactic Astrophysics	3
Approved Electives		**6**
Select two additional courses from the following list		
ASTR 332	High-Energy Astrophysics	
ASTR 342	General Relativity	
PHY 212	Electricity and Magnetism I	
PHY 213	Electricity and Magnetism II	
PHY 215	Classical Mechanics I	
PHY 340	Thermal Physics	
PHY 362	Quantum Mechanics I	
PHY 364	Nuclear and Elementary Particle Physics	
PHY 366	Introduction to String Theory	
Total Credits		**52-53**

A total of 120 credit hours are required for the Bachelor of Arts in Astronomy.

B.S. in Astrophysics Program Requirements

Mathematics Courses		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
MATH 208	Complex Variables	3-4
or MATH 320	Ordinary Differential Equations	
or MATH 322	Methods of Applied Analysis I	
Basic Science Courses		
PHY 011	Introductory Physics I	4
or PHY 010	General Physics I	
PHY 021	Introductory Physics II	0,4
PHY 012	Introductory Physics Laboratory I	1
PHY 022	Introductory Physics Laboratory II	1
PHY 031	Introduction to Modern Physics	3
CHM 030	Introduction to Chemical Principles	4
ASTR 105	Introduction to Planetary Astronomy	3
Laboratory and Computing Courses		
PHY 220	Advanced Physics Laboratory I	3
PHY 221	Advanced Physics Laboratory II	2
CSE 003	Introduction to Programming, Part A	2
or CSE 007	Introduction to Programming	
*Or an equivalent course in scientific computing.		
Intermediate and Advanced Courses		
PHY 212	Electricity and Magnetism I	3
PHY 213	Electricity and Magnetism II	3
PHY 215	Classical Mechanics I	4
PHY 340	Thermal Physics	3

PHY 362	Quantum Mechanics I	3
ASTR 301	Introduction to Stellar Astrophysics	3
ASTR 302	Introduction to Galactic and Extragalactic Astrophysics	3
Elective Courses		**12**
Select four Physics or Astronomy courses numbered higher than 100. Up to two courses in appropriate technical areas offered in other departments may be substituted, when selected with advisor approval. Students planning graduate work in physics are encouraged to include PHY 273 (Research) among their electives.		
Total Credits		**75-80**

A total of 123 credit hours are required for the Bachelor of Science in Astrophysics.

RECOMMENDED SEQUENCE OF COURSES FOR THE FIRST TWO YEARS

B.A. with Major in Astronomy

First Year

Fall	CR	Spring	CR
WRT 001	3	WRT 002	3
Big Questions Seminar	3-4	PHY 010 or 011	4
MATH 021 or 031	4	PHY 012	1
ASTR 007 & ASTR 008	4	MATH 022 or 032	4
		Disciplinary Perspectives*	4
	14-15		**16**

Second Year

Fall	CR	Spring	CR
PHY 013 or 021	3-4	ASTR 105	3
PHY 022	1	EES 021	3
MATH 023	4	PHY 031	3
Disciplinary Perspectives*	6-8	Disciplinary Perspectives*	3-4
		Free elective	3-4
	14-17		**15-17**

Total Credits: 59-65

B.S. Astrophysics

First Year

Fall	CR	Spring	CR
WRT 001	3	WRT 002	3
Big Question Seminar*	3-4	CHM 030	4
PHY 011 or 010	4	MATH 022 or 032	4
PHY 012	1	Disciplinary Perspectives*	4
MATH 021 or 031	4		
	15-16		**15**

Second Year

Fall	CR	Spring	CR
PHY 021	4	PHY 031	3
PHY 022	1	MATH 205	3
MATH 023 or 033	4	Disciplinary Perspectives*	8
CSE 003 or 007	2-4	ASTR 105	3
Disciplinary Perspectives*	4		
	15-17		**17**

Total Credits: 62-65

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Students may choose to select ASTR 007 by deferring a distribution requirement (though it is not required for the BS in Astrophysics).

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Or an equivalent course in scientific computing.

Departmental Honors in Astronomy or Astrophysics

Students receiving a BA in Astronomy or a BS in Astrophysics may earn Departmental Honors by satisfying the following requirements:

1. Academic Performance: Minimum grade point average of 3.50 in astronomy and physics courses used to satisfy the major degree requirements.
2. Research or Project-Based/Creative Activity: completion of approved[1] special topics courses in astronomy that include written reports, or completion of 6 credits of ASTR 273 (research) or equivalent, or completion of a summer research project with written report and oral presentation
3. Additional Course Work: Completion of at least one approved[1] 300-level course in either physics or astronomy beyond those required in the student's degree program. This course may not be selected from special topics or research courses.

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Specific approvals are granted by the Program Director.

The Minor Program in Astronomy

The minor in astronomy consists of 15 credits of astronomy and physics courses, at least 6 credits of which must be astronomy courses at or above the 100-level. No more than one course required in a student's major program may be included in the minor program. The minor program should be designed along a coherent intellectual theme in consultation with the Physics Department Chair. Examples of course sequences for the minor program can be found on the Physics Department Web Site.

Courses

ASTR 007 Introduction to Astronomy 3 Credits
Introduction to planetary, stellar, galactic, and extragalactic astronomy. An examination of the surface characteristics, atmospheres, and motions of planets and other bodies in our solar system. Properties of the sun, stars, and galaxies, including the birth and death of stars, stellar explosions, and the formation of stellar remnants such as white dwarfs, neutron stars, pulsars, and black holes. Quasars, cosmology, and the evolution of the universe. May not be taken by students who have previously completed ASTR 105, PHY 105,.
Attribute/Distribution: NS, NW, Q

ASTR 008 Introduction to Astronomy Laboratory 1 Credit
Laboratory to accompany ASTR 007. Must be enrolled concurrently in ASTR 007.
Corequisites: ASTR 007
Attribute/Distribution: LS, NS, NW

ASTR 091 Special Topics in Astrophysics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 105 Introduction to Planetary Astronomy 3 Credits
This course is an introduction to the solar system. Topics include observations of the sky, transition from the geocentric to the heliocentric paradigm, gravitational interactions, formation and evolution of the solar system, the structure of and energy production in the Sun, survey of the planets in the solar system, including their dynamics, interiors, atmospheres, composition, and moons, the nature of asteroids, comets, and the Kuiper belt, and the study of exoplanets. Instructor permission required in lieu of Phy 5/10/11.
Prerequisites: PHY 005 or PHY 010 or PHY 011
Attribute/Distribution: NS, NW, Q

ASTR 191 Special Topics in Astrophysics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 273 Research 2-3 Credits
Participation in current research projects being carried out within the department.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, Q

ASTR 291 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 300 Apprentice Teaching 1-4 Credits
Apprentice Teaching.

ASTR 301 Introduction to Stellar Astrophysics 3 Credits
This course will take an observational, theoretical, and computational perspective to investigate the physics of stars. Students will learn how to measure fundamental stellar properties (distance, brightness, mass, radius, and temperature). Students will combine astronomical data analysis with physical modeling, including applications from classical mechanics, quantum mechanics, thermodynamics, electromagnetism, and nuclear physics, to describe the atmosphere, internal structure, energy generation, and evolution of stars. Additional topics include: binary stars, variable stars, supernovae, white dwarfs, neutron stars, pulsars, and black holes.
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and PHY 031 and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS, Q, W

ASTR 302 Introduction to Galactic and Extragalactic Astrophysics 3 Credits
This course covers the astrophysics of the universe from stars to cosmological structure. We explore star clusters and stellar populations, and examine the components, structure, and dynamics of the Milky Way Galaxy. We investigate galactic morphology, classification, and evolution, including active galaxies and quasars. The course concludes with a short introduction to cosmology and an overview of galaxy clusters and intergalactic structure.
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and (MATH 022 or MATH 032 or MATH 052) and ASTR 301
Attribute/Distribution: NS, Q

ASTR 332 (PHY 332) High-Energy Astrophysics 3 Credits
Observation and theory of X-ray and gamma-ray sources, quasars, pulsars, radio galaxies, neutron stars, black holes. Results from ultraviolet, X-ray and gamma-ray satellites. Generally offered in the spring of odd-numbered years.
Prerequisites: PHY 021 and (MATH 023 or MATH 033) and PHY 031 and PHY 215
Can be taken Concurrently: MATH 023, MATH 033
Attribute/Distribution: NS, Q

ASTR 342 (PHY 342) General Relativity 3 Credits
An introduction to Einstein's theory of general relativity. Topics covered: the geometry of spacetime; curvature and the gravitational field equations; the Schwarzschild and Kerr black holes and more general spacetime geometries; black hole thermodynamics; gravitational waves; the Friedmann–Robertson–Walker geometry and inflationary cosmology; dark energy and the cosmological constant problem.
Prerequisites: (PHY 021) and (MATH 023 or MATH 033) and PHY 215
Can be taken Concurrently: MATH 023, MATH 033, PHY 215
Attribute/Distribution: NS, Q

ASTR 344 Cosmology 3 Credits
This course covers the large-scale evolution of our universe from the big bang until today and into the far future. Topics covered: Hubble expansion, Friedman equations, Einstein's biggest blunder, dark energy, dark matter, the standard model of cosmology (the so-called #CDM model), the cosmic microwave background, nucleosynthesis and inflation.
Prerequisites: PHY 021 and (MATH 023 or MATH 033) and PHY 215
Can be taken Concurrently: MATH 023, MATH 033, PHY 215
Attribute/Distribution: NS

ASTR 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

ASTR 391 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 491 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.

Biochemistry

An interdepartmental B.S. biochemistry major is offered in the College of Arts and Sciences. The B.S. in biochemistry degree is managed by an interdepartmental committee composed of biochemists, bioorganic chemists, and molecular/cellular biologists. The committee administers the degree, monitors the academic program, provides research possibilities, and advises student majors. The director of the program is currently Linda J. Lowe-Krentz. Faculty in both Biological Sciences and Chemistry serve as advisors.

BACHELOR OF SCIENCE DEGREE IN BIOCHEMISTRY

Collateral Science Requirements		
Select one of the following options:		9-10
Option A		
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
Option B		
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
Select one of the following options: [2]		10-12
Option A		
MATH 051	Survey of Calculus I	
MATH 052	Survey of Calculus II	
MATH 043	Survey of Linear Algebra	
Option B		
MATH 021	Calculus I	
MATH 022	Calculus II	
MATH 023	Calculus III	
One statistics course [2]		3
CSE 012	Introduction to Programming with Python	3
or ENGR 010	Applied Engineering Computer Methods	
or BIOS 237	Introductory Molecular Modeling and Simulation	
Required Chemistry Courses		
CHM 040	Honors General Chemistry I [3]	4
CHM 041	Honors General Chemistry II [3]	4
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
CHM 194	Physical Chemistry for Biological Sciences	3

CHM 307	Advanced Inorganic Chemistry	3
or CHM 364	Bioinorganic Chemistry	
CHM 332	Analytical Chemistry	3
or CHM 336	Clinical Chemistry	
Required Biological Science courses		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 115	Genetics	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
BIOS 377	Biochemistry Laboratory	3
Advanced Laboratory		4
Electives in Biological Sciences (3 hours minimum) [4]		3
Technical Writing (2 hours minimum)		2
Total Credits		**75-78**

1

16 hours to be broadly distributed in fields of thought other than natural science and mathematics, including at least 8 hours each in humanities and social sciences.

2

Mathematics option and statistics course must be at least 12 hours combined.

3

The CHM 030 / CHM 031 sequence may be substituted.

4

The three credit hours of biological sciences electives are chosen with the approval of the adviser.

MODEL PATTERN ROSTER

First Year	Credits
CHM 040	4
CHM 041	4
BIOS 041 & BIOS 042	4
WRT 001	3
WRT 002	3
BIOS 090	1-4
Select one of the following:	
MATH 051 & MATH 052	
MATH 021 & MATH 022	
Select one of the following:	
PHY 010 & PHY 012	
PHY 011 & PHY 012	
	19-22

Second Year	Credits
CHM 110 & CHM 111	4
CHM 112 & CHM 113	4
MATH 043 or 023	3
BIOS 115	3
BIOS 130[1]	4
Select one of the following:	
PHY 013 & PHY 022	
PHY 021 & PHY 022	
	18

Third Year	Credits
CHM 194	3
CHM 332	3
BIOS 371	3
BIOS 372	3
BIOS 377	3
CSE 012	3
Technical Writing	2
	20

Fourth Year	Credits
BIOS Advanced laboratory course(s)	
BIOS elective	
CHM 307	3
	3

Total Credits: 60-63

1

A statistics course from the MATH department could also fulfill the statistics requirement

Biological Sciences

The biological sciences include the study of living systems at levels ranging from the structure and function of molecules to the behavior and evolution of communities of organisms. The department offers four different routes to mastering skills and knowledge in this broad area. The B.A. and B.S. programs in biology provide a broad introduction to biology with opportunities for students to create a program of study suited to their specific interests. Programs of study focused on particular aspects of biology are the B.A. and B.S. degree in the areas of neuroscience and cellular and molecular biology. For programs in biochemistry and bioengineering, see those separate sections in the catalog.

The Department of Biological Sciences strongly supports the positions of both the American Association for the Advancement of Science and the National Academy of Sciences that intelligent design is not scientific and should not be presented as science in science classes.

The requirements for the B.A. and B.S. in biology, neuroscience, and cellular and molecular biology are listed below. Research interests of the faculty and instrumentation are described in the section on graduate education.

B.A. WITH MAJOR IN BIOLOGY

Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
Biology electives [1]		18

Mathematics		
Select one of the following:		4
MATH 051	Survey of Calculus I	
MATH 021	Calculus I	
Select one of the following:		3-4
MATH 052	Survey of Calculus II	
MATH 012	Basic Statistics and Data Science	
BIOS 130	Biostatistics	
Collateral Sciences		
Select one of the following:		4
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Total Credits		**49-50**

[1]

Biology electives must include one course from List A (see below) and one course from List B (see below). List C (see below) course electives can count as either List A or List B Biology electives. These will be chosen in consultation with the major advisor. No more than 3 credits can be used from the following courses: BIOS 161, BIOS 261, BIOS 262, BIOS 391, BIOS 393, College scholar project. Credits from BIOS 130 cannot be used to fulfill the biology elective requirement.

Biology Electives List A

Choose one of the following:

BIOS 234	Comparative Vertebrate Anatomy	4
BIOS 239	Ecology and Evolution of Infectious Diseases	3
BIOS 276	Central Nervous System and Behavior	3
BIOS 315	Neuropharmacology	3
BIOS 317	Evolution	3
BIOS 326	Coevolution	3
BIOS 332	Behavioral Neuroanatomy	3
BIOS 334	Species and Speciation	3
BIOS 335	Animal Behavior	3
BIOS 337	Behavioral Ecology	3
BIOS 382	Endocrinology	3
BIOS 385	Synapses, Plasticity and Learning	3
EES 152	Ecology	4
No more than one of the following:		
EES 250	Forest Ecology	4
EES 358	Microbial Ecology	3,4
EES 386	Wetland Ecology	3,4

Biology Electives List B

Choose one of the following:

BIOS 237	Introductory Molecular Modeling and Simulation	3
BIOS 324	Microbiology	3
BIOS 327	Development and Disease	3
BIOS 328	Immunology	3
BIOS 330	Molecular Evolution	3
BIOS 340	Molecular Basis of Disease	3
BIOS 342	Cellular Basis of Human Disease	3
BIOS 345	Molecular Genetics	3
BIOS 347	Advanced Topics in Genetics	3
BIOS 353	Virology	3
BIOS 367	Cell Biology	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
BIOS 381	Physical Biochemistry	3
BIOS 384	Eukaryotic Signal Transduction	3

Biology Electives List C

These courses can count as either List A or List B Biology Electives:

BIOS 235	Human Physiology	3
BIOS 323	Evolution of Development	
BIOS 338	Neurodegenerative Diseases in Model Organisms	3
BIOS 341	Living Together: The Science of Host-Microbe Interactions	3
BIOS 343	Personal Genomics	3
BIOS 365	Neurobiology of Sensory Systems	3
BIOS 366	Diseases of the Nervous System	3
BIOS 376	Developmental Biology	3
BIOS 386	Genes and the Brain	3

THE B.S. IN BIOLOGY

The Bachelor of Science in biology offers broad scientific preparation in biology to facilitate advanced work in the life sciences. Progression through the program is best served through early commitment.

Requirements for the B.S. in Biology

Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
BIOS 317	Evolution	3
Biology electives [1]		22
Mathematics		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
BIOS 130	Biostatistics	4
Collateral Sciences		
Select one of the following:		8
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
PHY 010	General Physics I	0-4
or PHY 011	Introductory Physics I	
PHY 012	Introductory Physics Laboratory I	1
PHY 013	General Physics II	3
or PHY 021	Introductory Physics II	

PHY 022	Introductory Physics Laboratory II	1
Total Credits		**69-74**

1

Biology electives must include two courses from List A (see below) and two courses from List B (see below) and at least four credits of laboratory experience (e.g., two 2 credit laboratory courses). List C (see below) course electives can count as either List A or List B Biology electives. These will be chosen in consultation with the major advisor.

Biology Electives List A

Choose two of the following:

BIOS 234	Comparative Vertebrate Anatomy	4
BIOS 239	Ecology and Evolution of Infectious Diseases	3
BIOS 276	Central Nervous System and Behavior	3
BIOS 315	Neuropharmacology	3
BIOS 323	Evolution of Development	3
BIOS 326	Coevolution	3
BIOS 332	Behavioral Neuroanatomy	3
BIOS 334	Species and Speciation	3
BIOS 335	Animal Behavior	3
BIOS 337	Behavioral Ecology	3
BIOS 348	Marine Biology	3
BIOS 382	Endocrinology	3
BIOS 385	Synapses, Plasticity and Learning	3
EES 152	Ecology	4
No more than one of the following:		
EES 250	Forest Ecology	4
EES 358	Microbial Ecology	3,4
EES 386	Wetland Ecology	3,4

Biology Electives List B

Choose two of the following:

BIOS 237	Introductory Molecular Modeling and Simulation	3
BIOS 324	Microbiology	3
BIOS 327	Development and Disease	3
BIOS 328	Immunology	3
BIOS 330	Molecular Evolution	3
BIOS 340	Molecular Basis of Disease	3
BIOS 342	Cellular Basis of Human Disease	3
BIOS 345	Molecular Genetics	3
BIOS 347	Advanced Topics in Genetics	3
BIOS 367	Cell Biology	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
BIOS 381	Physical Biochemistry	3
BIOS 384	Eukaryotic Signal Transduction	3

Biology Electives List C

These courses can count as either List A or List B Biology Electives:

BIOS 235	Human Physiology	3
BIOS 323	Evolution of Development	
BIOS 338	Neurodegenerative Diseases in Model Organisms	3
BIOS 341	Living Together: The Science of Host-Microbe Interactions	3
BIOS 365	Neurobiology of Sensory Systems	3
BIOS 366	Diseases of the Nervous System	3
BIOS 376	Developmental Biology	3
BIOS 386	Genes and the Brain	3

RECOMMENDED B.S. BIOLOGY SEQUENCE

First Year	CR
BIOS 041 & BIOS 042	4
MATH 051	4
MATH 052	3
CHM 030	4
CHM 031	4
	19

Second Year	CR
BIOS 115 & BIOS 116	4
AND/OR	
CHM 110 & CHM 111	4
BIOS 044 & BIOS 045	4
CHM 112 & CHM 113	4
BIOS 130	4
	20

Third Year	CR
BIOS 115 & BIOS 116 AND/OR BIOS 121 & BIOS 122	
PHY 010 & PHY 012	5
PHY 013 & PHY 022	4
Approved biology electives including two from list A and two from list B	9-12
	18-21

Fourth Year	CR
BIOS 317	3
Biology electives including at least 4 credits of laboratory	10-14
	13-17

Total Credits: 70-77

MINOR IN BIOLOGY

A minor in biology may be achieved by completing the following requirements (17-18 credits):

BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
BIOS 044	Introduction to Integrative and Comparative Biology	3
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
CHM 110	Organic Chemistry I	3
Biology electives at the 200 or 300 level		3-4
Total Credits		**17-18**

B.A. WITH MAJOR IN BEHAVIORAL NEUROSCIENCE

The B.A. in Behavioral Neuroscience is a natural science major for B.A. distribution purposes.

Required Major Courses

BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4

or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
BIOS 130	Biostatistics	4
BIOS 276	Central Nervous System and Behavior	3
Select two advanced Neuroscience courses		6
BIOS 315	Neuropharmacology	
BIOS 323	Evolution of Development	
BIOS 332	Behavioral Neuroanatomy	
BIOS 338	Neurodegenerative Diseases in Model Organisms	
BIOS 365	Neurobiology of Sensory Systems	
BIOS 366	Diseases of the Nervous System	
BIOS 376	Developmental Biology	
BIOS 382	Endocrinology	
BIOS 384	Eukaryotic Signal Transduction	
BIOS 385	Synapses, Plasticity and Learning	
BIOS 386	Genes and the Brain	
Lab Experience		
Select one of the following:		2
BIOS 277	Experimental Neuroscience Laboratory	
BIOS 278	Neurophysiology Laboratory	
BIOS 279	Experimental Molecular Neuroscience Laboratory	
BIOS 280	Neurogenetics and Behavior Laboratory	
BIOS 375	Methods in Developmental Biology Lab	
Select two additional major courses not already used above or from the list below.		**6-8**
BIOS 237	Introductory Molecular Modeling and Simulation	
BIOS 261	Special Topics in Biological Sciences	
BIOS 262	Research Proposal	
BIOS 317	Evolution	
BIOS 318	Advanced Phage Research Laboratory	
BIOS 324	Microbiology	
BIOS 326	Coevolution	
BIOS 327	Development and Disease	
BIOS 328	Immunology	
BIOS 330	Molecular Evolution	
BIOS 334	Species and Speciation	
BIOS 337	Behavioral Ecology	
BIOS 340	Molecular Basis of Disease	
BIOS 341	Living Together: The Science of Host-Microbe Interactions	
BIOS 342	Cellular Basis of Human Disease	
BIOS 343	Personal Genomics	
BIOS 345	Molecular Genetics	
BIOS 353	Virology	
BIOS 367	Cell Biology	
BIOS 391	Undergraduate Research	
PSYC 117	Cognitive Psychology	
PSYC 153	Personality	
PSYC 176	Cognitive Neuroscience	
Other approved 3xx BIOS electives can be chosen in consultation with the major advisor. [1]		
Math and Science Requirements for the B.A.		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Select one of the following:		4
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
PSYC 001	Introduction to Psychology	4
Total Credits		**56-59**

1 May not include BIOS 320, BIOS 347, BIOS 383, BIOS 387, BIOS 388

Other Options

The B.A. in Behavioral Neuroscience can be structured for a wide variety of possibilities (see listing of recommended elective courses). By using free electives to take additional science, the B.A. also can serve as a pre-professional degree for many graduate and professional schools. Students interested in a particular career based program should consult their advisor or the program director, Professor Michael Kuchka.

B.S. IN BEHAVIORAL NEUROSCIENCE

An early commitment to the B.S. is desirable to meet all the requirements of this program.

Required Major Courses		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
BIOS 130	Biostatistics	4
BIOS 276	Central Nervous System and Behavior	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
Select one of the following:		2
BIOS 277	Experimental Neuroscience Laboratory	
BIOS 278	Neurophysiology Laboratory	
BIOS 279	Experimental Molecular Neuroscience Laboratory	
BIOS 280	Neurogenetics and Behavior Laboratory	
BIOS 375	Methods in Developmental Biology Lab	
Advanced Neuroscience Course Requirement		
Select three of the following:		9

BIOS 315	Neuropharmacology	
BIOS 323	Evolution of Development	
BIOS 332	Behavioral Neuroanatomy	
BIOS 338	Neurodegenerative Diseases in Model Organisms	
BIOS 365	Neurobiology of Sensory Systems	
BIOS 366	Diseases of the Nervous System	
BIOS 376	Developmental Biology	
BIOS 382	Endocrinology	
BIOS 384	Eukaryotic Signal Transduction	
BIOS 385	Synapses, Plasticity and Learning	
BIOS 386	Genes and the Brain	
Advanced Lab Requirement for the B.S.		
Select one of the following:		2-3
Any advanced Neuroscience lab not used above		
BIOS 318	Advanced Phage Research Laboratory	
BIOS 325	Microbiology Laboratory	
BIOS 346	Molecular Genetics Laboratory	
BIOS 368	Cell Biology Laboratory	
BIOS 377	Biochemistry Laboratory	
BIOS 391	Undergraduate Research	
Math and Science Requirements for the B.S.		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Select one of the following:		8
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Select one of the following:		4-5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
PSYC 001	Introduction to Psychology	4
Major Electives		
Select two of the following:		6
Any additional Advanced Neuroscience course not fulfilling the requirement above or additional research credits. [1]		
BIOS 261	Special Topics in Biological Sciences	
BIOS 262	Research Proposal	
BIOS 317	Evolution	
BIOS 324	Microbiology	
BIOS 326	Coevolution	
BIOS 327	Development and Disease	
BIOS 328	Immunology	
BIOS 330	Molecular Evolution	
BIOS 335	Animal Behavior	
BIOS 337	Behavioral Ecology	
BIOS 341	Living Together: The Science of Host-Microbe Interactions	
BIOS 343	Personal Genomics	
BIOS 345	Molecular Genetics	
BIOS 353	Virology	
BIOS 367	Cell Biology	
PSYC 117	Cognitive Psychology	
PSYC 153	Personality	
PSYC 176	Cognitive Neuroscience	
Total Credits		**80-83**

1 Except BIOS 320, BIOS 347, BIOS 383, BIOS 387, BIOS 388.

B.A. WITH MAJOR IN MOLECULAR BIOLOGY

Requirements for the B.A. in Molecular Biology

Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
Advanced courses for the BA in Molecular and Cellular Biology		
BIOS 345 & BIOS 346	Molecular Genetics and Molecular Genetics Laboratory	5
or BIOS 218	SEA-GENES Laboratory	
BIOS 367	Cell Biology	3
BIOS 371	Elements of Biochemistry I	3
Advanced Laboratory		
Select one of the following:		2-3
BIOS 277	Experimental Neuroscience Laboratory	
BIOS 278	Neurophysiology Laboratory	
BIOS 279	Experimental Molecular Neuroscience Laboratory	
BIOS 280	Neurogenetics and Behavior Laboratory	
BIOS 318	Advanced Phage Research Laboratory	
BIOS 325	Microbiology Laboratory	
BIOS 368	Cell Biology Laboratory	
BIOS 375	Methods in Developmental Biology Lab	
BIOS 377	Biochemistry Laboratory	
BIOS 391	Undergraduate Research	
Approved Molecular and Cellular Electives		
Select at least two courses from the list below. Other approved electives can be chosen in consultation with the major advisor. *		9
BIOS 237	Introductory Molecular Modeling and Simulation	
BIOS 317	Evolution	
BIOS 323	Evolution of Development	
BIOS 324	Microbiology	
BIOS 327	Development and Disease	
BIOS 328	Immunology	
BIOS 330	Molecular Evolution	

BIOS 340	Molecular Basis of Disease	
BIOS 341	Living Together: The Science of Host-Microbe Interactions	
BIOS 342	Cellular Basis of Human Disease	
BIOS 343	Personal Genomics	
BIOS 347	Advanced Topics in Genetics	
BIOS 353	Virology	
BIOS 372	Elements of Biochemistry II	
BIOS 376	Developmental Biology	
BIOS 381	Physical Biochemistry	
BIOS 382	Endocrinology	
BIOS 384	Eukaryotic Signal Transduction	

* Can include BIOS 261, 262, 318 and 391.

Mathematics		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Chemistry		
Select one of the following:		4
CHM 030	Introduction to Chemical Principles	
CHM 040	Honors General Chemistry I	
Select one of the following:		4
CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 041	Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Physics		
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Select one of the following:		4-5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
Total Credits		**66-69**

THE B.S. IN MOLECULAR BIOLOGY

Requirements for the B.S. in Molecular Biology

Biology		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
or BIOS 043	Phage Hunting Laboratory	
BIOS 044 & BIOS 045	Introduction to Integrative and Comparative Biology and Introduction to Integrative and Comparative Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
or BIOS 118	Phage Genetics Laboratory	
BIOS 130	Biostatistics	4
Advanced courses for the BS in Molecular and Cellular Biology		
BIOS 345 & BIOS 346	Molecular Genetics and Molecular Genetics Laboratory	5
or BIOS 218	SEA-GENES Laboratory	
BIOS 367	Cell Biology	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
BIOS 381	Physical Biochemistry	3
Advanced Laboratory		
Select one of the following:		2-3
BIOS 277	Experimental Neuroscience Laboratory	
BIOS 278	Neurophysiology Laboratory	
BIOS 279	Experimental Molecular Neuroscience Laboratory	
BIOS 280	Neurogenetics and Behavior Laboratory	
BIOS 318	Advanced Phage Research Laboratory	
BIOS 325	Microbiology Laboratory	
BIOS 368	Cell Biology Laboratory	
BIOS 375	Methods in Developmental Biology Lab	
BIOS 377	Biochemistry Laboratory	
BIOS 391	Undergraduate Research	
Approved Molecular and Cellular Biology Electives		
Select at least two courses from the list below. Other approved electives can be chosen in consultation with the major advisor.		12
BIOS 237	Introductory Molecular Modeling and Simulation	
BIOS 261	Special Topics in Biological Sciences	
BIOS 262	Research Proposal	
BIOS 317	Evolution	
BIOS 318	Advanced Phage Research Laboratory	
BIOS 323	Evolution of Development	
BIOS 324	Microbiology	
BIOS 327	Development and Disease	
BIOS 328	Immunology	
BIOS 330	Molecular Evolution	
BIOS 340	Molecular Basis of Disease	
BIOS 341	Living Together: The Science of Host-Microbe Interactions	
BIOS 342	Cellular Basis of Human Disease	
BIOS 343	Personal Genomics	
BIOS 353	Virology	
BIOS 376	Developmental Biology	
BIOS 382	Endocrinology	
BIOS 384	Eukaryotic Signal Transduction	
BIOS 391	Undergraduate Research	
Mathematics		
Select one of the following:		7-8
MATH 021 & MATH 022	Calculus I and Calculus II	
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	
Chemistry		
Select one of the following:		4
CHM 030	Introduction to Chemical Principles	
CHM 040	Honors General Chemistry I	
Select one of the following:		4
CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 041	Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4

CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Physics		
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Select one of the following:		4-5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
Total Credits		**79-82**

RECOMMENDED SEQUENCE FOR THE B.S. IN MOLECULAR BIOLOGY

First Year	CR
BIOS 041 & BIOS 042	4
MATH 021	4
MATH 022	4
CHM 030	4
CHM 031	4
	20

Second Year	CR
BIOS 115 & BIOS 116	4
CHM 110 & CHM 111	4
CHM 112 & CHM 113	4
PHY 010 & PHY 012	5
PHY 013 & PHY 022	4
	21

Third Year	CR
BIOS 044 & BIOS 045	4
BIOS 324 or 328	3
BIOS 325, 368, or 377	2
BIOS 345 & BIOS 346	5
BIOS 371 & BIOS 372	6
	20

Fourth Year	CR
BIOS 367	3
BIOS 381	3
BIOS Approved Molecular Biology Electives	12
	18

Total Credits: 79

MOLECULAR BIOLOGY MINOR

Minor Program		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
BIOS 115 & BIOS 116	Genetics and Genetics Laboratory	4
BIOS 345 & BIOS 346	Molecular Genetics and Molecular Genetics Laboratory	5
BIOS coursework at the 200 or 300 level (minimum 4 additional credits).		4
Collateral coursework		
MATH 051 or MATH 021	Survey of Calculus I Calculus I	4
CHM 030	Introduction to Chemical Principles	4
CHM 110	Organic Chemistry I	3
Total Credits		**28**

DEPARTMENTAL HONORS

A student may apply for admission to the departmental honors program through a potential thesis advisor. Requirements for Departmental Honors include a major GPA of 3.25 and at least 2 semesters of 300-level research for a minimum of 6 cr. The student must write a research proposal for their project and a thesis at the conclusion of their research. This work must be presented in a symposium at the end of the project. Students must meet regularly with their advisor and research group to discuss their research progress and also must complete the year-long, 2-course sequence for BIOS honors students (BIOS 387 and BIOS 388).

SPECIAL HEALTH PROFESSIONS PROGRAMS

Students may apply for admission to an accelerated B.A.-Doctor of Medicine program and a B.A.-Doctor of Medical Dentistry program. A seven-year B.A.M.D. program is offered in conjunction with Drexel University College of Medicine, and a seven year B.A.D.M.D. program is offered in conjunction with the University of Pennsylvania School of Dental Medicine. Students in these programs receive a B.A. from Lehigh and a graduate degree from the designated professional school within a seven-year period. For details concerning admission to these programs, see Health Professions (p. 60).

GRADUATE STUDY IN THE BIOLOGICAL SCIENCES

A research oriented program leading to a Doctor of Philosophy in Biology is offered, with concentrations in: biochemistry (https://www.lehigh.edu/~inbios/Grad/Grad_DDP.html#biochem), evolution and behavior (https://www.lehigh.edu/~inbios/Grad/Grad_DDP.html#evolution), neuroscience (https://www.lehigh.edu/~inbios/Grad/Grad_DDP.html#neuro) and cell and molecular biology (https://www.lehigh.edu/~inbios/Grad/Grad_DDP.html#cell). To complete the program students must successfully complete core courses, pass a qualifying exam, prepare, submit, and successfully defend a written research proposal, complete the research described in the proposal, and submit a written dissertation and defend the completed research to the department.

Once students enter the department, their progress is monitored by the graduate committee until they are admitted to candidacy. Members of the committee meet with the student each semester to assess the student's progress towards the degree and to assist students in choosing the appropriate courses to provide a solid scientific foundation and an up-to-date understanding of the discipline. This will be assessed by the qualifying exam.

The qualifying exam generally should be taken after the third semester and no later than the fourth semester of course work. It will be prepared, administered and graded by the faculty associated with the specific graduate program in which the student is enrolled. It consists of a two-day written exam and an oral examination. The exam can be repeated once. Admission to candidacy is granted after successful completion of the qualifying exam and the thesis proposal. The proposal is a written description of an original research project developed under the guidance of a faculty member chosen by the student to be his/her advisor. The proposal will be presented orally to the thesis committee, typically after the fifth semester. Following the presentation of the proposal, an oral examination will take place in which the thesis committee will question the student about general science related to the project. This will constitute the general examination.

Core requirements for each division are listed below. The graduate school requires students to register for at least 72-post baccalaureate credits to earn the Ph.D. In addition, all students must take BIOS 408 (0 credits) Responsible Conduct of Science within their first year of graduate study. All students must also attend departmental seminars and enroll in BIOS 406 (1 credit) Biological Sciences Seminar at least twice in the first four semesters. A minimum of 24 course credits may be chosen from upper level courses in biochemistry, molecular biology, cell biology, behavioral biology and evolutionary biology, and neuroscience. At least 12 of these credits must be at the 400 level.

Concentration: Biochemistry

In the Biochemistry concentration, research areas include DNA/RNA structure and function, regulation of protein synthesis, and signal transduction. Students admitted to graduate study in the biochemistry concentration will typically have an undergraduate degree in Chemistry or Biochemistry. Students with an undergraduate degree in a related discipline are expected to have the following undergraduate preparation for graduate study - beyond introductory chemistry and a year of organic chemistry, at least one semester of analytical chemistry and one semester of physical chemistry-thermodynamics and kinetics, with appropriate math. Students without that background are expected to take courses to fulfill those requirements as part of their graduate study.

GRADUATE STUDY IN BIOLOGY

A rigorous, research-oriented graduate program leading to a Doctor of Philosophy in Biology with concentrations in biochemistry; molecular and cell biology; neuroscience; and evolution and behavior is offered in the Department of Biological Sciences. To complete the program students must successfully complete 24 course credits, pass a qualifying exam, prepare, submit, and successfully defend a written research proposal, complete the research described in the proposal, and submit a written dissertation and defend the completed research to the department.

Once students enter the department, their progress is monitored by the graduate committee until they are admitted to candidacy. Members of the committee meet with the student each semester to assess the student's progress towards the degree and to assist students in choosing the appropriate courses to provide a solid scientific foundation and an up-to-date understanding of the discipline. This will be assessed by the qualifying exam.

The qualifying exam will be completed during the fourth semester in the program. The proposal-based qualifying exam will require students to generate a specific hypothesis that extends from current findings within the literature, and to design an appropriate experimental approach to test their hypothesis. The exam will consist of two parts: a written proposal and an oral examination. The goal of the exam is to test the student's depth and breadth of knowledge in their chosen field. If a student fails their first attempt at the written proposal or the oral examination, they will be provided one opportunity to re-do each component of the qualifying exam. Admission to candidacy is granted after successful completion of the qualifying exam.

Next, a thesis proposal is a written description of an original research project developed under the guidance of a faculty member chosen by the student to be his/her advisor. The proposal will be presented orally to the thesis committee, typically after the fifth semester. Following the presentation of the proposal, an oral examination will take place in which the thesis committee will question the student about general science related to the project. This will constitute the general examination. In summary, the successful completion of coursework, the qualifying exam, and the defense of a Dissertation Proposal/General Examination are requirements for Admission to Candidacy, the second stage of the graduate experience.

Course requirements for each concentration are listed below. The graduate school requires students to register for at least 72-post baccalaureate credits to earn the Ph.D. In addition, all students must take the Program Core listed below. A minimum of 24 course credits may be chosen from upper level courses in biochemistry, molecular biology, cell biology, behavioral biology and evolutionary biology, and neuroscience. At least 12 of these credits must be at the 400 level.

Program Core		
BIOS 401	Professional Skills for Biological Sciences Graduate Students	3
BIOS 402	Ethics and Rigor in Research	1
BIOS 406	Biological Sciences Seminar (2 semesters (1 credit each semester))	2
BIOS 408	Responsible Conduct of Science	0

Biochemistry concentration

In the biochemistry program, research areas include DNA structure and function, regulation of protein synthesis, and signal transduction. Students admitted to graduate study in biochemistry will typically have an undergraduate degree in chemistry or biochemistry. Students with an undergraduate degree in a related discipline will be expected to have the following undergraduate preparation for graduate study beyond introductory chemistry and a year of organic chemistry: at least one semester of analytical chemistry and one semester of physical chemistry thermodynamics and kinetics, with appropriate math. Students without that background will be expected to take courses to fulfill those requirements as part of their graduate study.

Core Competency Courses		
Required if background is insufficient. Need will be determined by the Graduate Committee based on the student's academic history.		
BIOS 473	Principles of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
Concentration Electives		
Concentration electives, choose 3-4 courses, (1-12 credits). Note: If both BIOS 473 and BIOS 372 were taken, choose only 2 courses.		
BIOS 471	Eukaryotic Signal Transduction	3
BIOS 472	Lipids and Membranes	3
BIOS 474	Computational, Molecular Modeling and Simulation	3
Free Electives		
400 or 300-level courses outside of concentration or department. Choose 1-3 courses together with the Graduate Committee or Research Advisor. (3-9 credits)		

neuroscience concentration

The graduate program in neuroscience is designed to train students in advanced topics in neuroscience with emphases on the behavioral, synaptic, cellular, endocrinology, and physiological aspects of neurobiology. The mission of the program is to create students who are broadly trained and uniquely capable of asking questions and solving problems at the interface of these traditionally defined fields. Students admitted to the program should have a basic knowledge of anatomy, physiology, behavioral and cellular neuroscience. Students will begin by taking core courses providing a broad, integrative foundation in neuroscience at the graduate level and work toward a Ph.D. with a concentration in neuroscience. Regardless of concentration, all students develop an appreciation for the fact that all aspects of biology, whether cellular, physiological, anatomical, behavioral, evolutionary, or social, are inextricably linked and cannot be fully understood as separate, parallel systems of knowledge.

NEUROSCIENCE CONCENTRATION

Depending on the student's background, additional courses may be required.

Core Competency Course		
Required if background is insufficient. Need will be determined by the Graduate Committee based on the student's academic history.		
BIOS 404	Behavioral Neuroscience	3
Concentration Electives		
Choose 3-4 courses (9-12 credits)		
BIOS 415	Synapses, Plasticity and Learning	
BIOS 424	Advanced Neurobiology of Sensory Systems	

BIOS 438	Neurodegenerative Diseases in Model Organisms	
BIOS 453	General Neuroanatomy	
BIOS 457	Advanced Behavioral Neuroendocrinology	
BIOS 486	Genes and the Brain	
Free Electives		
400 or 300-level courses outside of concentration or department. Choose 1-3 courses together with the Graduate Committee or Research Advisor. (3-9 credits)		

BEHAVIOR AND EVOLUTION CONCENTRATION

The graduate program in evolution and behavior is designed to train students in advanced organismal biology with emphasis on behavioral ecology, evolution, and/or functional morphology. The mission of the program is to create students who are broadly trained and uniquely capable of asking questions and solving problems at the interface of these traditionally defined fields. Students admitted to the program should have a basic knowledge of evolution, anatomy, physiology and/or behavioral ecology. Students will begin by taking core courses providing a broad, integrative foundation in evolution and behavior at the graduate level and work toward a Ph.D. with a concentration in evolution and behavior. Regardless of concentration, all students develop an appreciation for the fact that all aspects of biology, whether cellular, physiological, anatomical, behavioral, evolutionary, or social, are inextricably linked and cannot be fully understood as separate, parallel systems of knowledge.

BEHAVIOR AND EVOLUTION CONCENTRATION

Core Competency Course		
Required if background is insufficient. Need will be determined by the Graduate Committee based on the student's academic history.		
BIOS 317	Evolution	
Concentration Electives		
Choose 3-4 courses (9-12 credits)		
BIOS 423	Evolution of Development	
BIOS 426	Coevolution	
BIOS 428	Molecular Evolution	
BIOS 434	Speciation	
BIOS 439	Advanced Behavioral Ecology	
BIOS 448	Marine Biology	
BIOS 449	Molecular Ecology	
Free Electives		
400 or 300-level courses outside of concentration or department. Choose 1-3 courses together with the Graduate Committee or Research Advisor. (3-9 credits)		

CELL AND MOLECULAR BIOLOGY CONCENTRATION

In the cell and molecular biology program, research areas include microbial evolution and genetics, plant and animal molecular genetics, eukaryotic cell biology, and regulation of gene expression.

Core Competency Course		
Required if background is insufficient. Need will be determined by the Graduate Committee based on the student's academic history.		
BIOS 345	Molecular Genetics	3
Concentration Electives		
Choose 3-4 courses (9-12 credits)		
BIOS 411	Advanced Cell Biology	
BIOS 421	Molecular Cell Biology I	
BIOS 422	Molecular Cell Biology II	
BIOS 442	Cellular Basis of Human Disease	
BIOS 443	Personal Genomics	
BIOS 466	Structure and Function of RNAs and Ribonucleoprotein Complexes	
Free Electives		
400 or 300-level courses outside of concentration or department. Choose 1-3 courses together with the Graduate Committee or Research Advisor. (3-9 credits)		

Facilities available for research in the biological sciences include core facilities with equipment (for example, for DNA synthesis, confocal microscopy, digital imaging, chromatography, cell culture, centrifugation, controlled environments, gamma and scintillation counting, flow cytometry, and rodent surgery). Individual research laboratories and advanced teaching laboratories contain a variety of additional equipment. Ongoing interactions with a variety of private companies contribute additional opportunities for student experiences.

Courses

BIOS 010 Bioscience in the 21st Century 3 Credits
A multidisciplinary survey of advances in bioscience. Exploration of themebased topics (e.g., infectious diseases, cancer, genomebase medicine, engineered biomedical systems) coupled with social/ethical considerations. Three lectures per week. Participation in online multidisciplinary discussion, writing assignments, field trips, and/or other activities.
Attribute/Distribution: NS, NW

BIOS 032 (EES 032) Oceanography 3 Credits
An introduction to the structure, composition, and processes of the earth from a marine perspective. Topics include earth structure, plate tectonics, continental margins, coastal processes, seawater chemistry, ocean circulation, wave dynamics, primary productivity, plankton and plants, marine organisms and communities. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS, NW

BIOS 041 Introduction to Cellular and Molecular Biology 0,3 Credits
Basic building blocks and higher order structures required for cellular processes. Topics include the character of membranes, the molecular/cellular basis of energy production, cell cycle progression, DNA replication, gene expression, basic Mendelian genetics, signal transduction, and cell division.
Prerequisites: CHM 075 or CHM 025 or CHM 030 or CHM 040
Can be taken Concurrently: CHM 075, CHM 025, CHM 030, CHM 040
Attribute/Distribution: NS, NW

BIOS 042 Introduction to Cellular and Molecular Biology Laboratory 1 Credit
Techniques and experiments related to the principal topics covered in BIOS 041; emphasis on experimental design and scientific communication.
Prerequisites: BIOS 041
Can be taken Concurrently: BIOS 041
Attribute/Distribution: NS, NW, W

BIOS 043 Phage Hunting Laboratory 2 Credits
The first laboratory research course in a two-semester series (as part of the Howard Hughes Medical Institute's SEA-PHAGES Program) that focuses on the isolation (from local soil), as well as the physical and genomic characterization of novel bacteriophages that infect mycobacteria. Course will substitute for BIOS 42. Application and acceptance into Lehigh's SEA program required (see www.lehigh.edu/~insea); freshman status in the spring semester or permission of the instructor. Co-requisite: BIOS 41 or instructor permission.
Prerequisites: BIOS 041
Can be taken Concurrently: BIOS 041
Attribute/Distribution: NS, Q

BIOS 044 Introduction to Integrative and Comparative Biology 0,3 Credits
Experimental and historical approaches to the analysis of structural and functional properties in organisms. Use of scientific method to study species diversity. Introduction to the analysis of organismal attributes that explain behavioral repertoire and ecological relationships. Prerequisites: BIOS 041 and (BIOS 042 or BIOS 043).
Prerequisites: BIOS 041 and (BIOS 042 or BIOS 043)
Attribute/Distribution: CC, NS

BIOS 045 Introduction to Integrative and Comparative Biology Laboratory 1 Credit
Experiments and discussions related to the topics covered in BIOS 044; emphasis on experimental design and scientific communication.
Prerequisites: BIOS 044
Can be taken Concurrently: BIOS 044
Attribute/Distribution: LS, NS, Q

BIOS 115 Genetics 0,3 Credits
The structure, function, and continuity of hereditary information. Classical genetic analysis. Molecular biology of genes and genomes. Population genetics and evolution. Genetics of complex traits.
Prerequisites: BIOS 041
Attribute/Distribution: NS

BIOS 116 Genetics Laboratory 1 Credit
Introduction to model organisms; techniques used in molecular genetics; experimental design and scientific communication.
Prerequisites: BIOS 115
Can be taken Concurrently: BIOS 115
Attribute/Distribution: NS

BIOS 118 Phage Genetics Laboratory 2 Credits
Part of a 2-semester series focusing on genetic analysis of novel bacteriophage genomes to determine gene function using recombineering strategies. Phage genome annotation using bioinformatics for previously sequenced phage genomes. Additional genetics, molecular biology, and/or biochemical research on previously isolated bacteriophages may also be included.
Prerequisites: BIOS 115
Can be taken Concurrently: BIOS 115
Corequisites: BIOS 115
Attribute/Distribution: NS, W

BIOS 130 (MATH 130) Biostatistics 0,4 Credits
Elements of statistics and probability theory with emphasis on biological applications. Statistical analysis of experimental and observational data.
Prerequisites: MATH 052 or MATH 022 or MATH 032
Attribute/Distribution: Q

BIOS 161 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty sponsor supervision. Only 3 credits can be counted toward any life science major. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 041
Attribute/Distribution: NS

BIOS 202 Biomedical Externship 0-3 Credits
Analysis of individualized experiences at external biomedical clinical or research sites. Limited enrollment. May not be taken for passfail grading. May not be used to satisfy any life science major or minor requirement. Consent of department chair required.
Attribute/Distribution: NS

BIOS 218 SEA-GENES Laboratory 2 Credits
A third semester extension of the SEA-PHAGES lab experience. A course-based research experience with goals established by the Howard Hughes Medical Institute - the cloning of all genes of a chosen bacteriophage, the testing of the functions of individual bacteriophage genes by phenotypic assays, the identification of host proteins that physically interact with a limited subset of bacteriophage proteins - the ultimate goal of which is establishing a complete data set for the chosen bacteriophage.
Prerequisites: BIOS 043 and BIOS 118
Attribute/Distribution: NS

BIOS 234 Comparative Vertebrate Anatomy 4 Credits
A course in vertebrate zoology with emphasis on the study of homologous body structures in the various vertebrate classes and their relationship to the functional demands of habit and environment in each class. Detailed dissections of representative vertebrates are made in the laboratory. Two lectures and two laboratory periods.
Prerequisites: BIOS 044 and BIOS 045
Attribute/Distribution: NS

BIOS 235 Human Physiology 3 Credits
The goal of this course is to provide students with a thorough understanding of the major systems of the human body. Students will examine many of the major body systems including Nervous, Muscular, Cardiac, Respiratory, and Digestive systems. These systems will be analyzed by their components at both the cellular and molecular level. Students will also examine how each system functions as a whole and how it interacts with other systems at the organismal level.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 237 (BIOC 237) Introductory Molecular Modeling and Simulation 3 Credits
Key concepts, methods, and tools used in molecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.
Prerequisites: CHM 030 or CHM 040
Attribute/Distribution: NS

BIOS 238 Epigenetics, Health, and Environment 3 Credits
Foundational concepts in environmental epigenetics. Course will be centered around presentations and discussions of studies that address current issues, such as the mechanisms behind heritable health effects of acute malnourishment in human populations across multiple generations, or the potential for extremely fast evolutionary adaptation in species threatened by environmental change. This course may be listed as a Writing Intensive course.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 239 Ecology and Evolution of Infectious Diseases 3 Credits
In this course, we will explore the causes and consequences of infectious disease at multiple scales—from whole organisms to entire ecosystems. By evaluating primary literature, leveraging theoretical models, and considering experimental design, we will aim to apply evolutionary and ecological understanding to the epidemics of the past, present, and future.
Prerequisites: BIOS 044 and BIOS 045
Attribute/Distribution: CC, NS

BIOS 251 Writing and Biological Sciences 3 Credits
A course designed to acquaint students with some of the intellectual foundations of science, with attention to the distinctiveness of the biological sciences. Format includes readings, intensive writing, extemporaneous speaking, and discussion. May not be used to fulfill Biology B.A. elective requirements.
Attribute/Distribution: NS, W

BIOS 261 Special Topics in Biological Sciences 1-3 Credits
Research, conferences and reports on selected topics not covered in the general undergraduate offerings. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, W

BIOS 262 Research Proposal 3 Credits
Literature and methods of research in area of department faculty expertise. Requires development of detailed proposal for research to be performed in senior year. Must have major in any biological sciences degree program, junior standing, GPA of 3.0 in major, and consent of department.
Attribute/Distribution: NS, W, WRIT

BIOS 274 (HMS 274) Neuroethics 3 Credits
The intersection of neuroscience and ethics. History of biomedical science and current topics in neuroethics explored through weekly case studies and relevant readings in neurobiology. Examples include: definitions of mental illness, definitions of consciousness and brain death, addiction neuroscience, brain-machine interfaces, wearable technology, social determinants of health and equity within science and medicine. Reading and critical analysis of scientific articles, integration of biological concepts with moral reasoning, effective written communication and participation in peer review, oral presentations and group discussions.
Prerequisites: BIOS 044
Attribute/Distribution: NS, W

BIOS 276 Central Nervous System and Behavior 0,3 Credits
Neuronanatomy and neurophysiology of animal and human behavior. Feeding, thirst, sleep, emotions, learning, and psychopathology.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 277 Experimental Neuroscience Laboratory 2 Credits
Structure and function of the mammalian brain with special attention to cellular morphology and organization. Widely used histological and behavioral techniques to determine how the shape and function of the nervous system regulates behavior. Experimental design, hypothesis testing, statistical analysis, reading and writing of scientific papers, basic histology and imaging.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS, W

BIOS 278 Neurophysiology Laboratory 2 Credits
The functional electrical underpinnings of the nervous system explored through direct recordings and thorough data analyses. Experimental design, hypothesis testing, numerical analysis, reading and writing of primary science.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS, Q

BIOS 279 Experimental Molecular Neuroscience Laboratory 2 Credits
Inquiry-based lab course emphasizing molecular and cellular neuroscience approaches to understanding the nervous system. Opportunity for making real research discoveries on the genetic and cellular underpinnings of brain function. Molecular genetic, bioinformatic, and neurochemical techniques. Can be taken more than once with instructor approval.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS

BIOS 280 Neurogenetics and Behavior Laboratory 2 Credits
Inquiry-based lab course utilizing functional genetic and behavioral approaches to understand nervous system function. This course will provide students with opportunities to employ genome engineering techniques and behavioral analysis to make real research discoveries about the genetic underpinnings of behavior. This course is an approved lab for the Neuroscience major.
Prerequisites: BIOS 115 and BIOS 116

BIOS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

BIOS 315 Neuropharmacology 3 Credits
Mechanisms of drug action in the central nervous system. Pharmacokinetics/pharmacodynamics. Depressant, stimulants, analgesics, and psychedelics. Treatments for neuropsychiatric disorders. Drug abuse.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 317 Evolution 0,3 Credits
Mechanisms of evolution, emphasizing genetic structure and variation of populations, and isolation. Origin of species and higher taxa. Rates of evolution, extinction.
Prerequisites: BIOS 115
Attribute/Distribution: CC, NS

BIOS 318 Advanced Phage Research Laboratory 1-3 Credits
Apprentice-based laboratory research in phage biology in collaboration with faculty who direct Lehigh's SEA Phages Program (sponsored by the Howard Hughes Medical Institute). Research will focus on discoveries uncovered in SEA Phage courses and may include genetic, molecular, and biochemical analyses of novel bacteriophage genes, genomes, and novel gene functions. Additional research may include phage genome annotation using computational biology tools.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 115 and BIOS 118
Attribute/Distribution: NS

BIOS 320 (ENTP 320) The Business of Life Science 3 Credits
An examination of business process in startup, early stage and developing bioscience companies. Technology assessment, business plan and proposal preparation, financial strategies, resource management, intellectual property, and legal as well as regulatory issues. Cannot be used to fulfill major or minor requirements in Biological Sciences.
Prerequisites: BIOS 121
Attribute/Distribution: NS

BIOS 323 Evolution of Development 3 Credits
This course examines how changes in the blueprint that describes the development of a multicellular animal from a single fertilized egg lead to the evolution of new species or new forms within a species.
Prerequisites: BIOS 317 or BIOS 376 or BIOS 327
Can be taken Concurrently: BIOS 317, BIOS 376, BIOS 327

BIOS 324 Microbiology 3 Credits
An examination of microbial life, including archaea, bacteria, fungi, protists and viruses. Emphasis on microbial molecular genetics and its relationship to the origin of life, human health/medicine, and the environment.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 325 Microbiology Laboratory 2 Credits
Laboratory studies of microorganisms, focusing on bacteria and fungi. Techniques for isolating, culturing, and identifying microorganisms. Experiments in microbial molecular genetics, phylogenetics, and evolution using traditional and modern techniques, as well as other topics covered in BIOS 324.
Prerequisites: BIOS 324
Can be taken Concurrently: BIOS 324
Attribute/Distribution: NS

BIOS 326 Coevolution 3 Credits
Discussion-based seminar course covering readings from the primary literature. Course will examine evolutionary consequences of species interactions, interactions between the sexes, and genetic interactions. Topics will include predator-prey interactions, host-parasite interactions, sexual conflict, genomic conflict, mutualism, and more. Consequences of coevolution for biodiversity and human health will also be examined.
Prerequisites: BIOS 317
Attribute/Distribution: NS

BIOS 327 Development and Disease 3 Credits
Development of organs from precursor cells; diseases that impact organ function. Focus on understanding how mutations or other causes influence organ development and function. Combination lecture and primary literature.
Prerequisites: BIOS 376
Attribute/Distribution: NS

BIOS 328 Immunology 3 Credits
Distinction of "self" and "nonself" through humoral and cellular mechanisms. Antigens; biochemical structures, cellular mechanisms, genetic control and processing, phylogenetic distribution, diseased states.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 330 Molecular Evolution 3 Credits
This course will focus on evolution at the level of individual genes, proteins, and genomes, alternating between lecture and discussion of papers from the recent primary literature. Topics include pathways for adaptive evolution, directionality in evolution, epistasis, evolvability, genome rearrangements and speciation, gene duplication, and evolutionary dynamics. We will draw on examples of molecular evolution in nature, laboratory model systems, and human pathogens.
Prerequisites: BIOS 317 or BIOS 345
Can be taken Concurrently: BIOS 317, BIOS 345
Attribute/Distribution: NS

BIOS 332 Behavioral Neuroanatomy 3 Credits
The study of neuroanatomy that underlies social and motivated behaviors and the techniques that support this study. Students learn by researching and reporting on original research, and ultimately designing and describing an original study on the topic.
Prerequisites: BIOS 276
Attribute/Distribution: NS, W

BIOS 334 Species and Speciation 3 Credits
Consideration of the origin of species. Discussion of a variety of "species" definitions and exploration of the evolutionary mechanisms by which new species arise. Alternation between lecture and discussion, drawing on the textbook and on current and classical literature.
Prerequisites: BIOS 317

BIOS 335 (PSYC 335) Animal Behavior 3 Credits
Discussion of the behavior of invertebrates and vertebrates and analysis of the physiological mechanisms responsible for behavioral stimuli, and adaptive value of specific behavior patterns.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 336 Animal Behavior Laboratory 2 Credits
Experiments and field observations illustrating principles discussed in BIOS 335. Emphasis on observing animals, performing experiments, collecting and analyzing data, and individual research. Six hours of laboratory per week.
Prerequisites: BIOS 335 or BIOS 337
Can be taken Concurrently: BIOS 335, BIOS 337
Attribute/Distribution: NS

BIOS 337 Behavioral Ecology 3 Credits
Social systems of vertebrate and invertebrate groups. Emphasis on ecological and evolutionary factors that influence social behavior.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 338 Neurodegenerative Diseases in Model Organisms 3 Credits
Discussion-based seminar course on the use of model systems to investigate neurodegenerative diseases. The primary focus will be on invertebrate model systems, including Drosophila. Critical reading of primary scientific literature and student discussion is required.
Prerequisites: BIOS 115
Attribute/Distribution: W

BIOS 339 Computational, Molecular Modeling and Simulation 3 Credits
This course is designed to introduce the most basic and key concepts, methods, and tools used in molecular modeling and simulation. This class is a hybrid of lecture and hands-on practice styles, using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Some topics include the UNIX operating system, text editors, Python programming and Monte Carlo simulation. The understanding of these concepts and algorithms, as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.
Attribute/Distribution: NS

BIOS 340 Molecular Basis of Disease 3 Credits
Lectures and student projects on molecular mechanisms of human disease. Physiology of disease, molecular mechanisms, therapeutic approaches, ongoing research. Topics include: neurodegenerative diseases, cancer, autoimmune diseases, infectious diseases.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 341 Living Together: The Science of Host-Microbe Interactions 3 Credits
This course explores the fascinating and complex world of host-microbe interactions, examining the impact of host-associated microbes on biodiversity, ecology, and evolution. Using primary literature, we investigate the diversity of these interactions and the mechanisms driving them, and engage in lively group discussions and collaborative mini-reviews that hone scientific communication skills. By the end of the course, you will have gained a deep understanding of the latest research on host-microbe interactions and the tools to evaluate and communicate scientific ideas.
Prerequisites: BIOS 044 or BIOS 121 and BIOS 115

BIOS 342 Cellular Basis of Human Disease 3 Credits
Cell and molecular biological advanced topics relevant to human disease and/or health. Critical reading of the primary literature, discussion and student discussion required.
Prerequisites: BIOS 367 or BIOS 411
Attribute/Distribution: NS

BIOS 343 Personal Genomics 3 Credits
Contemporary methods and technologies for investigating human genetic variation and its use for inferring ancestry and risk for disease, along with discussions of relevant policy and ethics. Readings will include primary scientific literature in population and statistical genetics, government publications, and news reports. Final projects will involve development of outreach and education resources in this topic for non-experts.
Prerequisites: (BIOS 115 and BIOS 130) or BIOS 317
Attribute/Distribution: CC, NS

BIOS 345 Molecular Genetics 3 Credits
The organization and replication of genetic material; mutagenesis; mechanisms of regulation; mechanisms of gene transmission involving prokaryotes and eukaryotes and their viruses; techniques for intervention into genetic organization and expression.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 346 Molecular Genetics Laboratory 2 Credits
Laboratory experiments related to the topics covered in BIOS 345. Emphasis is on molecular characterization of DNA and the principles of gene isolation and transfer.
Prerequisites: BIOS 345
Can be taken Concurrently: BIOS 345
Attribute/Distribution: NS

BIOS 347 Advanced Topics in Genetics 3 Credits
Lectures and student projects on selected aspects of genetics such as the genetics and evolution of particular organisms, regulation of gene expression and transmission, human genetics, gene therapy, etc. Consent of department chair.
Prerequisites: BIOS 115 and BIOS 116
Attribute/Distribution: NS

BIOS 348 Marine Biology 3 Credits
Ecology and adaptations of marine species, populations and ecosystems. Studying life in the ocean requires a perspective that spans spatial and temporal scales from the planetary to the microscopic, from the geologic to the physiological, and from the surface to the deepest seafloor. Through this course, students develop a fundamental understanding of how the physical environment of planet earth shapes and is shaped by marine organisms.
Prerequisites: BIOS 041 and BIOS 042
Attribute/Distribution: CC, NS

BIOS 349 Molecular Ecology 3 Credits
Molecular ecology is a field of research that seeks to answer questions in ecology, evolution, behavior and conservation; through the use of molecular tools. Biological scales range from organisms, to populations and species. This is a discussion-based course. Students read, present and analyze classic and modern scientific literature. Students also formulate a research proposal addressing outstanding questions in the field.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 353 Virology 3 Credits
An introduction to viruses and their interactions with host organisms. Topics include viral pathogenesis, from entry through release, viral immune evasion mechanisms, and viral evolution. Vaccines, antiviral strategies, as well as therapeutic uses of viruses for gene therapy will be emphasized.
Prerequisites: BIOS 115
Attribute/Distribution: CC, NS

BIOS 365 Neurobiology of Sensory Systems 3 Credits
The fundamental features of sensory systems in a diverse array of animals. Focus on how nervous systems detect, compute, and internally represent aspects of the environment from the single cell to whole system level. Special attention to the way sensory processing influences how we think about the biological basis of perception and possible mechanisms for consciousness. Instructor permission required.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 366 Diseases of the Nervous System 3 Credits
Neurobiological basis of CNS disorders, including affective, neurological and psychotic conditions. Emphasis on primary literature covering causes, diagnostic and treatment issues.
Prerequisites: BIOS 276 or BIOS 382
Attribute/Distribution: NS

BIOS 367 Cell Biology 3 Credits
Molecular aspects of cell biology. Emphasis on membrane structure and function, organelle biogenesis, cell motility, the cytoskeleton, and extracellular matrix.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 368 Cell Biology Laboratory 2 Credits
Basic methods used in cell biology laboratories around the world and the opportunity to carry out an independent research project. Techniques include histology and microscopy (both white and fluorescent light), tissue culture and sterile procedures, cellular fractionation, nuclear import assays, and immunological probing. Consent of department required.
Prerequisites: BIOS 367
Can be taken Concurrently: BIOS 367
Attribute/Distribution: NS

BIOS 371 (CHM 371) Elements of Biochemistry I 0,3 Credits
A general study of carbohydrates, proteins, lipids, nucleic acids and other biological substances and their importance in life processes. Protein and enzyme chemistry are emphasized. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

BIOS 372 (CHM 372) Elements of Biochemistry II 3 Credits
Dynamic aspects of biochemistry; enzyme reactions including energetics, kinetics and mechanisms; metabolism of carbohydrates, lipids, proteins and nucleic acids; photosynthesis, electron transport mechanisms, coupled reactions, phosphorylations, and the synthesis of biological macromolecules.
Prerequisites: BIOS 473 or ((BIOS 371 or CHM 371) and BIOS 041)
Attribute/Distribution: NS

BIOS 375 Methods in Developmental Biology Lab 2 Credits
Detection of gene expression and protein expression in vivo or in vitro. Mutants and/or transgenics examined. Students address research questions of instructor.
Prerequisites: BIOS 376
Attribute/Distribution: NS

BIOS 376 Developmental Biology 3 Credits
Differentiation of multicellular organisms from a single cell. Axis determination; gradients; induction and pattern formation viewed through modern analysis of regulated gene expression. Lecture topics on organ formation paired with discussions on birth defects and human diseases.
Prerequisites: BIOS 115 and BIOS 116
Attribute/Distribution: NS

BIOS 377 (CHM 377) Biochemistry Laboratory 0,3 Credits
Laboratory studies of the properties of chemicals of biological origin and the influence of chemical and physical factors on these properties. Laboratory techniques used for the isolation and identification of biochemicals.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 041)
Can be taken Concurrently: BIOS 371, CHM 371
Attribute/Distribution: ND

BIOS 381 Physical Biochemistry 3 Credits
Topics include: thermodynamics of biological systems; Forces acting on and between biological molecules; Principles of macromolecular structure; Physical methods used to characterize biomolecules; and other topics to be determined.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 041)
Attribute/Distribution: NS

BIOS 382 (PSYC 382) Endocrinology 3 Credits
Organization and function of endocrine and neuroendocrine systems in regulating physiology and behavior. Emphasis on mammalian systems. Focus on critical thinking and problem-solving with reference to basic literature.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 383 Biological Sciences Colloquia 0,1 Credits
Analysis of weekly colloquia in the biological sciences.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 044
Attribute/Distribution: NS

BIOS 384 Eukaryotic Signal Transduction 3 Credits
Signal transduction between cells of multicellular eukaryotic organisms examined in the context of specialized functions that include: nutrition, hormones and neurotransmitters, vision, muscle contraction, adhesion, and the immune system. The evolution of cancer based on mutations in these signaling systems.
Prerequisites: BIOS 367 or BIOS 372 or CHM 372 or BIOS 382 or BIOS 365
Attribute/Distribution: W

BIOS 385 Synapses, Plasticity and Learning 3 Credits
Communication between neurons. Physiology of synaptic transmission; varying forms of neuronal plasticity; acquisition, encoding, and retrieval of memory.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 386 Genes and the Brain 3 Credits
Modern molecular genetics techniques applied to complex brain processes. Emphasis on DNA and RNA manipulation strategies to elucidate mechanisms of complex behaviors. Animal models of learning, behavioral plasticity, and neuropsychiatric diseases.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 387 Biological Sciences Honors Seminar 1 Credit
Development, presentation and implementation of research proposals, and discussions of research. Required for senior biology, molecular biology, biochemistry, and behavioral neuroscience majors pursuing departmental honors. Departmental permission required.
Attribute/Distribution: ND

BIOS 388 Biological Sciences Honors Seminar 1 Credit
Continuation and extension of BIOS 387. Departmental permission required.
Attribute/Distribution: ND

BIOS 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

BIOS 391 Undergraduate Research 1-3 Credits
Laboratory research under tutorial with a faculty member. Must have junior standing. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

BIOS 393 Thesis 3 Credits
Literature review and design of project in selected area, execution of the project, final report and presentation. Consent of department required. Intended for senior majors in BIOS only. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

BIOS 401 Professional Skills for Biological Sciences Graduate Students 3 Credits
Students learn expectations and fundamental skills related to success in the biological sciences. The course is designed to help students make the most out of their graduate education. Students learn the principles underlying fundable, publishable research, and how these general principles can be applied to their specific research area. They learn to write and review manuscripts and grant proposals by serving on a mock editorial board and scientific review panel. They gain experience in giving oral presentations. Readings are from texts on scientific writing and research styles, and from original journal articles and grant proposals written by the faculty. Required of all Integrative Biology graduate students.

BIOS 402 Ethics and Rigor in Research 1 Credit
This course covers material critical to the responsible conduct of science, in addition to data reproducibility, rigor, research ethics, and misconduct.

BIOS 404 (PSYC 404) Behavioral Neuroscience 3 Credits
Theoretical and empirical issues in biopsychology. Must have graduate standing.

BIOS 405 Special Topics in Molecular Biology 1-3 Credits
Research, conferences, and reports on selected topics not covered in the general graduate offerings.
Repeat Status: Course may be repeated.

BIOS 406 Biological Sciences Seminar 0,1 Credits
An advanced seminar in current developments including departmental research. Required for candidates for graduate degrees in molecular biology.
Repeat Status: Course may be repeated.

BIOS 407 Research in Biological Science 1-9 Credits
Laboratory investigations in one of the department's research areas.

BIOS 408 Responsible Conduct of Science 0 Credits
Responsible practice in research. Training in general laboratory methods; human subjects concerns; radiation safety; chemical hazards; aseptic technique; physical, mechanical, biological, and fire hazards; animal welfare. Occupational and workplace considerations. Recombinant DNA guidelines; patent and proprietary rights; controversies over applications of science. Appropriate aspects required of investigators in all departmental research projects.

BIOS 410 Special Topics in Behavioral and Evolutionary Bioscience 1-3 Credits
Readings and discussions on selected topics not covered in the general graduate offerings.

BIOS 411 Advanced Cell Biology 3 Credits
Cell structure and biochemistry, as related to specialized cell functions.

BIOS 415 Synapses, Plasticity and Learning 3 Credits
Communication between neurons. Physiology of synaptic transmission; varying forms of neuronal plasticity; acquisition, encoding and retrieval of memory.

BIOS 421 Molecular Cell Biology I 3 Credits
Molecular aspects of cell structure, cell motility, intracellular transport; and biomembrane dynamics.
Prerequisites: BIOS 411

BIOS 422 Molecular Cell Biology II 3 Credits
Molecular aspects of gene expression, including genome structure and replication, RNA synthesis/processing, and protein synthesis.
Prerequisites: BIOS 345 or BIOS 345

BIOS 423 Evolution of Development 3 Credits
This course examines how changes in the blueprint that describes the development of a multicellular animal from a single fertilized egg lead to the evolution of new species or new forms within a species.
Prerequisites: BIOS 317 or BIOS 376 or BIOS 327
Can be taken Concurrently: BIOS 317, BIOS 376, BIOS 327

BIOS 424 Advanced Neurobiology of Sensory Systems 3 Credits
This course is designed to provide an overview of core principles of neuroscience through exploration of sensory systems. The course will provide an intensive review of fundamental neural signaling followed by a broad introduction to the major sensory pathways. Focus will be on major organizing principles of neural systems, and information processing. Student discussions and presentations will incorporate current literature and concepts.

BIOS 426 Coevolution 3 Credits
Discussion-based seminar course covering readings from the primary literature. Course will examine evolutionary consequences of species interactions, interactions between the sexes, and genetic interactions. Topics will include predator-prey interactions, host-parasite interactions, sexual conflict, genomic conflict, mutualism, and more. Consequences of coevolution for biodiversity and human health will also be examined.

BIOS 427 Techniques in Cell and Molecular Biology 1-3 Credits
Laboratory experiences in three or more cell and molecular biological techniques: gel electrophoresis of nucleic acids/proteins; polymerase chain reaction; DNA/RNA sequencing; molecular hybridization techniques; fluorescence microscopy; confocal microscopy; flow cytometry; electron microscopy tissue preparation; immunological detection methods; molecular cloning techniques; oocyte microinjection techniques; tissue culture methods; and autoradiography.

BIOS 428 Molecular Evolution 3 Credits
Evolution at the level of individual genes, proteins, and genomes. Lectures and discussion of papers from the recent primary literature. Topics include pathways for adaptive evolution, directionality in evolution, epistasis, evolvability, genome rearrangements and speciation, gene duplication, and evolutionary dynamics. Examples of molecular evolution in nature, laboratory model systems, and human pathogens.
Prerequisites: BIOS 317 or BIOS 345
Can be taken Concurrently: BIOS 317, BIOS 345

BIOS 431 Advanced Topics in Cell Biology 3 Credits
Current research problems in cell biology.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 367 or BIOS 367 or BIOS 411

BIOS 432 Advanced Topics in Molecular Genetics 3 Credits
Current research in molecular genetics.
Repeat Status: Course may be repeated.

BIOS 433 Advanced Topics in Developmental Biology 3 Credits
Current research problems in developmental biology.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 345 or BIOS 345

BIOS 434 Speciation 3 Credits
Discussion-based seminar course covering readings from classical and current literature, including both theoretical and empirical contributions. Topics will be included species concepts, reproductive isloation, mechanisms and modes of speciation, and current approaches to studying speciation.

BIOS 435 Epigenetics 3 Credits
Foundational concepts in environmental epigenetics. Course will be centered around presentations and discussions of studies that address current issues, such as the mechanisms behind heritable health effects of acute malnourishment in human populations across multiple generations, or the potential for extremely fast evolutionary adaptation in species threatened by environmental change.

BIOS 438 Neurodegenerative Diseases in Model Organisms 3 Credits
Discussion-based seminar course on the use of model systems to investigate neurodegenerative diseases. The primary focus will be on invertebrate model systems, including Drosophila. Critical reading of primary scientific literature and student discussion is required.
Prerequisites: BIOS 115

BIOS 439 Advanced Behavioral Ecology 3 Credits
Critical evaluation of the theoretical foundation in sociobiology. Emphasis placed on kinship, altruism, mate choice, parental investment, parent-offspring conflict, etc. Lectures and seminars. Not open to students who have taken BIOS 337.
Prerequisites: BIOS 317 or BIOS 317

BIOS 441 Living Together: The Science of Host-Microbe Interactions 3 Credits
This course explores the fascinating and complex world of host-microbe interactions, examining the impact of host-associated microbes on biodiversity, ecology, and evolution. Using primary literature, we investigate the diversity of these interactions and the mechanisms driving them, and engage in lively group discussions and collaborative mini-reviews that hone scientific communication skills. By the end of the course, you will have gained a deep understanding of the latest research on host-microbe interactions and the tools to evaluate and communicate scientific ideas.

BIOS 442 Cellular Basis of Human Disease 3 Credits
Cell and molecular biological advanced topics relevant to human disease and/or health. Critical reading of the primary literature, discussion and student discussion required.
Prerequisites: BIOS 367 or BIOS 411

BIOS 443 Personal Genomics 3 Credits
Contemporary methods and technologies for investigating human genetic variation and its use for inferring ancestry and risk for disease, along with discussions of relevant policy and ethics. Readings will include primary scientific literature in population and statistical genetics, government publications, and news reports. Final projects will involve development of outreach and education resources in this topic for non-experts.

BIOS 448 Marine Biology 3 Credits
Ecology and adaptations of marine species, populations, and ecosystems. With an average depth of more than two miles, the ocean makes up more than 95% of the habitable space on our planet. Ocean ecosystems are essential life support systems for the entire earth. Studying life in the ocean requires a perspective that spans spatial and temporal scales from the planetary to the microscopic, from the geologic to the physiological, and from the surface to the deepest seafloor. Through this course,.

BIOS 449 Molecular Ecology 3 Credits
Molecular ecology is a field of research that seeks to answer questions in ecology, evolution, behavior and conservation; through the use of molecular tools. Biological scales range from organisms, to populations and species. This is a discussion-based course. Students read, present and analyze classic and modern scientific literature. Students also formulate a research proposal addressing outstanding questions in the field.

BIOS 450 Developmental Neurobiology 3 Credits
Fundamental mechanisms underlying neural development. Early events leading to the induction of the neuroectoderm and the reorganization of the vertebrate central nervous system during adulthood and aging. Major developmental events such as phenotype commitment, cell migration, differentiation and growth cone guidance. Emphasis on the interplay between concepts emerging from organismal and molecular levels of analyses.

BIOS 453 General Neuroanatomy 3 Credits
Graduate level study of the neuroanatomy and neurochemistry of systems that underlie behavior in vertebrates. Emphasis will be on the traditional and novel methodologies used to reveal neuroanatomical pathways as well as the function of these pathways. Consent of department required.

BIOS 457 Advanced Behavioral Neuroendocrinology 3 Credits
A seminar course that covers current primary literature on the hormone-nervous system interactions that underlie physiology and behavior. The course covers the neuroendocrinology of reproduction, sex behavior, parental behavior, social behavior, agonistic and territorial behavior, learning and memory, homeostasis (caloric, nutritional, water and salt balance, temperature regulation), circadian rhythms and seasonality in a variety of vertebrates.

BIOS 464 Molecular Biology of Eukaryotic Organisms 3 Credits
Comparative analysis of several eukaryotes as model systems in cell biology, developmental biology, genetics, and molecular biology.

BIOS 466 Structure and Function of RNAs and Ribonucleoprotein Complexes 3 Credits
Biochemistry and function of small nuclear RNPs, RNase P, ribosomes, self-splicing introns, signal recognition particle, RNA viruses. Functions of RNA in DNA replication, in regulation, as an enzyme, and as a repressor.

BIOS 471 Eukaryotic Signal Transduction 3 Credits
Signal transduction between and within cells of multicellular organisms examined in the context of specialized functions that include: nutrition, hormones and neurotransmitters, vision, muscle contraction, adhesion and the immune system. The evolution of cancer based on mutations in these signaling systems. Lecture, discussion, and student presentations.
Prerequisites: (BIOS 372 or CHM 372 or BIOS 411)

BIOS 472 (CHM 472) Lipids and Membranes 3 Credits
The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.
Prerequisites: BIOS 372 or CHM 372

BIOS 473 (CHM 473) Principles of Biochemistry I 3 Credits
Study of proteins, carbohydrates, lipids, nucleic acids and other biological substances. Protein and enzyme chemistry are emphasized. Must have completed one year each of general chemistry and organic chemistry.

BIOS 474 Computational, Molecular Modeling and Simulation 3 Credits
This course is designed to introduce the basic and advanced concepts, methods, and tools used in molecular modeling and simulation. This class is a hybrid of lecture and hands-on practice styles, using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but are not limited to) the UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank) format, molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms, as well.

BIOS 477 (CHM 477) Topics in Biochemistry 1-3 Credits
Selected areas of biochemistry, such as mechanisms of enzyme action, new developments in the chemistry of lipids, nucleic acids, carbohydrates and protiens.
Repeat Status: Course may be repeated.

BIOS 483 Special Topics in Behavioral Neuroscience 3 Credits
Examination of the biological substrates of behavior. Topics may include animal communication, sociobiology, behavioral endocrinology, or behavior genetics.
Repeat Status: Course may be repeated.

BIOS 486 Genes and the Brain 3 Credits
Modern molecular genetics techniques applied to complex brain processes. Emphasis on DNA and RNA manipulation strategies to elucidate mechanisms of complex behaviors. Animal models of learning, behavioral plasticity, and neuropsychiatric diseases.
Attribute/Distribution: NS

BIOS 488 Seminar in Neuroscience, Behavior, and Evolution 1 Credit
Advanced seminar in current research developments.

BIOS 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

BIOS 499 Dissertation 1-15 Credits

Biology

Biology, life science, and related courses at Lehigh University are offered in a variety of settings that reflect the various levels of organization in life science and different orientations relating to areas of application. The College of Arts and Sciences offers degree programs in Behavioral Neuroscience, Biochemistry, Biology, Earth and Environmental Science, and Molecular Biology. The P. C. Rossin College of Engineering and Applied Science offers a degree program in Bioengineering. Refer to the catalog entries below for complete descriptions.

Major and Minor Programs	Catalog Entry
Behavioral Neuroscience (BA or BS)	Biological Sciences
Biochemistry	Biochemistry (BS only)
Bioengineering (BS only)	Bioengineering
Biology (BA or BS)	Biological Sciences
Earth and Environmental Science	Earth and Environmental Sciences
Molecular Biology (BA or BS)	Biological Sciences

Courses related to life science interest can be found under the catalog entries above as well as in other departments, including Chemical Engineering, Chemistry, Mathematics, Physics, Psychology, and Sociology and Anthropology

Chemistry

Chemistry is a versatile subject area and the pursuit of a career in chemistry can be a most intellectually satisfying experience. No other basic science touches and shapes as many aspects of modern society as does chemistry. The study of chemistry has provided solutions to complex problems and has improved the quality of all phases of human life from soft contact lenses and synthetic blood to longer-lasting paint and alternative fuels. A particular strength of this department is in surface and interface chemistry, which bridges many areas of modern science and technology.

Chemists at all levels of education find a market for their skills and knowledge in many employment areas. Chemists provide the technical backbone for the manufacturing industries (pharmaceuticals, plastics, paper, semiconductor electronics technology, and agriculture), for service industries (clinical and forensic laboratories, academe, environmental protection, and information science) and for governmental positions in regulatory agencies and in science policy analyses. Many chemists are employed in nontraditional areas, such as patent law, insurance underwriting, sales, product management, journalism, and even banking.

The alluring challenge of chemistry inspires many bachelor degree recipients to study for advanced degrees within the discipline of chemistry and in other areas, as well. Chemistry or biochemistry is the strongest preparation for graduate studies or for professional school in the health-related disciplines (medicine, pharmacology, and biochemistry), and for other science programs (materials science, polymers, biotechnology, environmental studies, and mineralogy).

The study of chemistry opens doors to satisfying careers, to a stimulating view of the world, and to a professional life in which one's natural tendency to ask "Why?" can lead to personally rewarding endeavors. The undergraduate curriculum in chemistry contains many of the prerequisites for biology, earth and environmental sciences, materials science, molecular biology, physics, and chemical engineering. This allows students to transfer credits among these majors through the sophomore year.

Chemistry students have the opportunity to design their undergraduate curricula for specialization in a variety of fields through the choice of both degree program and some additional courses.

DEGREE PROGRAMS

The Department of Chemistry offers undergraduate degrees in both the College of Arts and Sciences and the Rossin College of Engineering and Applied Sciences. Students in the College of Arts and Sciences have three options: the B. S. in Chemistry, the B. A. in Chemistry, and the B. S. in Pharmaceutical Chemistry. In addition we offer an interdepartmental B. S. in Biochemistry in collaboration with the Department of Biological Sciences. For students in the College of Engineering and Applied Sciences we offer the B. S. in Chemistry.

In the College of Arts and Sciences, the traditional degree certified by the American Chemical Society is offered; the B. S. degree in the College of Engineering is the ACS certified degree and is identical in terms of degree program requirements, but the college level requirements are different. All B. S. programs share several common "core" chemistry courses, and have similar collateral science requirements. although the options are different depending on the specific degree program chosen. The B.S. programs are pre-professional in nature, and students planning to attend graduate school in chemistry or an allied science should elect the ACS certified B. S. program in the college to which they have been admitted. The traditional B. A. Program in the College of Arts and Sciences is not a pre-professional program and may be elected by students who do not plan to do graduate work in chemistry or allied sciences but who desire a stronger background in chemistry than is provided by a chemistry minor.

In addition to the traditional certified B. S degree and B. A. degrees, a regular non-ACS certified B. S. Chemistry program is available in the College of Arts and Sciences. Students may transfer from a B. S. program to a B. A. program easily, but the reverse is more difficult, considering both the number of required chemistry courses and the more restrictive collateral courses in Mathematics and Physics. Students in a B. A. program who make the decision to attend graduate school in chemistry or allied sciences can achieve a minimum preparation for this transition by electing CHM 307 Advanced Inorganic Chemistry as an additional course, and by taking additional 300 level chemistry courses.

The Department of Chemistry also offers a Ph.D. in Chemistry for qualified students -- see the Graduate Tab.

DEGREES IN THE COLLEGE OF ARTS AND SCIENCES

In the College of Arts and Sciences the Chemistry Department offers three degrees: a B.S. in Chemistry, a B.A. in Chemistry and a B.S. in Pharmaceutical Chemistry with an interdepartmental B.S. in Biochemistry degree with the Department of Biological Sciences. The B.S. in Chemistry degree has two tracks: 1) the American Chemical Society accredited B.S. in Chemistry degree, and 2) a B.S. in Chemistry degree that is not accredited that requires fewer credits. All degree programs require appropriate Mathematics and Physics collateral courses, and some require an introduction to programming course.

With regard to the B.S. in Pharmaceutical Chemistry, the pharmaceutical industry is focused on exploring the biochemistry of disease and designing or finding drugs to cure or ameliorate disease. Biochemists, organic chemists, biologists, and chemical engineers collaborate to achieve this end. The majority of chemists hired today go into the pharmaceutical industry. The B.S. in Pharmaceutical Chemistry is a chemistry degree option which focuses on core chemistry, biochemistry, and molecular biology to prepare students for careers in this field. Since it is a highly interdisciplinary field it requires the breadth of knowledge offered by this degree program.

Common "core" Chemistry courses

The following courses are required for ANY of the undergraduate degree programs administered by the Department of Chemistry (not Biochemistry). One of the general chemistry sequences is taken in the first year, with organic chemistry in the second year. Most of the required chemistry courses are at the 300 level, and are distributed between the third and fourth years.

Select one of the following:		8
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	
or		
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
CHM 332	Analytical Chemistry	3
Concentrations (see below)		3-8
CHM 307	Advanced Inorganic Chemistry	3
CHM 351	Professional Development Seminar	2
Total Credits		**27-32**

Collateral requirements

The B.S. in Chemistry degree programs require Path A below for the collateral requirements. The B.S. in Pharmaceutical Chemistry, the B.A. in Chemistry, and the B.S. in Biochemistry requires EITHER Path A or Patch B. A course from Path A may replace a course in Path B, but the opposite is not true. Thus it is suggested that students consider the MATH 21, 22, 23 sequence if a B.S. in Chemistry degree program is one of their options.

Path A		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
ENGR 010	Applied Engineering Computer Methods	2
or CSE 003	Introduction to Programming, Part A	
Total Credits		**27**

Path B		
MATH 051	Survey of Calculus I	4
MATH 052	Survey of Calculus II	3
MATH 043	Survey of Linear Algebra	3
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	5
PHY 013 & PHY 022	General Physics II and Introductory Physics Laboratory II	4
Total Credits		**19**

SPECIALIZATIONS

The table directly below lists the course requirements for the two B.S. degrees. It should be noted that the ACS Certified Degree is the "gold standard" and is the best degree program to prepare for graduate work in Chemistry or a closely related field.

B.S. Chemistry (ACS certified Degree)

CHM 040	Honors General Chemistry I	4
or CHM 030	Introduction to Chemical Principles	
CHM 041	Honors General Chemistry II	4
or CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
CHM 307	Advanced Inorganic Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 334	Advanced Chemistry Laboratory I	3
CHM 335	Advanced Chemistry Laboratory II	3
CHM 341	Molecular Structure, Bonding and Dynamics	3
CHM 342	Thermodynamics & Kinetics	3
CHM 343	Physical Chemistry Laboratory	2
CHM 351	Professional Development Seminar	2
CHM 371	Elements of Biochemistry I	3
CHM 375	Research Chemistry Laboratory	2
Advanced Chemistry Elective Requirement		
Select one course from two of the three areas listed below:		6
Analytical Chemistry (CHM 350) [1]		
CHM 336	Clinical Chemistry	
CHM 356	Spectral Analysis	
CHM 388	Polymer Characterization	
Biochemistry (CHM 350) [1]		
CHM 323	Chemical Biology	
CHM 362	Molecular Biophysics	
CHM 365	Protein Separation & Biophysical Analysis	
CHM 372	Elements of Biochemistry II	
CHM 373	Lipids and Membranes	
CHM 377	Biochemistry Laboratory	
Inorganic Chemistry (CHM 350) [1]		
CHM 305	Organometallic Chemistry	
CHM 337	Crystallography and Diffraction	
CHM 340	Solid-State Chemistry	
CHM 364	Bioinorganic Chemistry	
Collateral Requirements		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5

Select one from the following:		2-4
ENGR 010	Applied Engineering Computer Methods	
CSE 003	Introduction to Programming, Part A	
CSE 007	Introduction to Programming	
Total Credits		**76-78**

[1]

CHM 350 may be applied to any one of the three areas, provided it is for a 3 credit lecture course and the particular section has been identified to fit into one of these three areas based on course content. CHM 350 may be repeated for credit if a different topic is offered, and if appropriate, a second CHM 350 section may count under a different area.

B.S. Chemistry- Analytical/Physical Concentration

CHM 040	Honors General Chemistry I	4
or CHM 030	Introduction to Chemical Principles	
CHM 041	Honors General Chemistry II	4
or CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
CHM 307	Advanced Inorganic Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 334	Advanced Chemistry Laboratory I	3
CHM 335	Advanced Chemistry Laboratory II	3
CHM 341	Molecular Structure, Bonding and Dynamics	3
CHM 342	Thermodynamics & Kinetics	3
CHM 343	Physical Chemistry Laboratory	2
CHM 351	Professional Development Seminar	2
Collateral Requirements		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
Select one of the following:		2-4
ENGR 010	Applied Engineering Computer Methods	
CSE 003	Introduction to Programming, Part A	
CSE 007	Introduction to Programming	
Total Credits		**65-67**

B. A. Chemistry

The B.A. in Chemistry degree program is considerably less rigorous than either track under the B.S. in Chemistry degree, but is sometimes chosen as a second major to pair with another major in a single B.A. degree. Note the choices in the collateral courses that clearly indicate either Path A or Path B may be chosen for these non-chemistry required courses.

CHM 040	Honors General Chemistry I	4
or CHM 030	Introduction to Chemical Principles	
CHM 041	Honors General Chemistry II	4
or CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Select one of the follwoing:		3
CHM 194	Physical Chemistry for Biological Sciences	
CHM 342	Thermodynamics & Kinetics	
CHM 307	Advanced Inorganic Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 343	Physical Chemistry Laboratory	2
CHM 351	Professional Development Seminar	2
Advanced CHM elective (300 Level)		**3**
Select one of the following:		
CHM 305	Organometallic Chemistry	
CHM 323	Chemical Biology	
CHM 334	Advanced Chemistry Laboratory I	
CHM 336	Clinical Chemistry	
CHM 337	Crystallography and Diffraction	
CHM 340	Solid-State Chemistry	
CHM 341	Molecular Structure, Bonding and Dynamics	
CHM 346	Photochemistry of Consequence	
CHM 350	Special Topics	
CHM 356	Spectral Analysis	
CHM 357	Organic Reaction Mechanisms	
CHM 358	Advanced Organic Chemistry	
CHM 362	Molecular Biophysics	
CHM 364	Bioinorganic Chemistry	
CHM 365	Protein Separation & Biophysical Analysis	
CHM 371	Elements of Biochemistry I	
CHM 372	Elements of Biochemistry II	
CHM 373	Lipids and Membranes	
CHM 375	Research Chemistry Laboratory	
CHM 376	Advanced Research Chemistry Laboratory	
CHM 377	Biochemistry Laboratory	
CHM 388	Polymer Characterization	
CHM 391	Colloid and Surface Chemistry	
CHM 393	Physical Polymer Science	
CHM 394	Organic Polymer Science I	
Collateral Requirements		**19-21**
MATH 021	Calculus I	
or MATH 051	Survey of Calculus I	
MATH 022	Calculus II	
or MATH 052	Survey of Calculus II	
MATH 205	Linear Methods	
or MATH 043	Survey of Linear Algebra	
PHY 011	Introductory Physics I	
or PHY 010	General Physics I	
PHY 012	Introductory Physics Laboratory I	
PHY 021	Introductory Physics II	
or PHY 013	General Physics II	
PHY 022	Introductory Physics Laboratory II	
Total Credits		**51-53**

B.S. Pharmaceutical Chemistry

The B.S. in Pharmaceutical Chemistry has some required Biological Science courses as background for entry into the field. As a consequence, there are fewer Chemistry courses, and they are tailored to the requirements of the pharmaceutical industry. Note the flexibility in the collateral requirements is the same as for the B.A. degree.

CHM 040	Honors General Chemistry I	4
or CHM 030	Introduction to Chemical Principles	
CHM 041	Honors General Chemistry II	4

or CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
Select one of the following:		3
CHM 194	Physical Chemistry for Biological Sciences	
CHM 342	Thermodynamics & Kinetics	
CHM 307	Advanced Inorganic Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 351	Professional Development Seminar	2
CHM 358	Advanced Organic Chemistry	3
CHM 371	Elements of Biochemistry I	3
CHM 372	Elements of Biochemistry II	3
Advanced CHM Elective (300 Level)		**3**
Select one of the following:		
CHM 305	Organometallic Chemistry	
CHM 323	Chemical Biology	
CHM 334	Advanced Chemistry Laboratory I	
CHM 336	Clinical Chemistry	
CHM 337	Crystallography and Diffraction	
CHM 340	Solid-State Chemistry	
CHM 341	Molecular Structure, Bonding and Dynamics	
CHM 346	Photochemistry of Consequence	
CHM 350	Special Topics	
CHM 356	Spectral Analysis	
CHM 357	Organic Reaction Mechanisms	
CHM 362	Molecular Biophysics	
CHM 364	Bioinorganic Chemistry	
CHM 365	Protein Separation & Biophysical Analysis	
CHM 373	Lipids and Membranes	
CHM 375	Research Chemistry Laboratory	
CHM 376	Advanced Research Chemistry Laboratory	
CHM 377	Biochemistry Laboratory	
CHM 388	Polymer Characterization	
CHM 391	Colloid and Surface Chemistry	
CHM 393	Physical Polymer Science	
CHM 394	Organic Polymer Science I	
Biological Sciences		
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
BIOS 115	Genetics	3
Collateral Requirements		**19-21**
MATH 012	Basic Statistics and Data Science [1]	
MATH 021	Calculus I	
or MATH 051	Survey of Calculus I	
MATH 022	Calculus II	
or MATH 052	Survey of Calculus II	
MATH 205	Linear Methods	
or MATH 043	Survey of Linear Algebra	
PHY 011	Introductory Physics I	
or PHY 010	General Physics I	
PHY 012	Introductory Physics Laboratory I	
PHY 021	Introductory Physics II	
or PHY 013	General Physics II	
PHY 022	Introductory Physics Laboratory II	
Total Credits		**65-67**

1

MATH 012 may be substituted by any statistics course with the approval of the department chair.

MODEL ROSTER WHEN PATH A IS FOLLOWED FOR THE B.S. IN CHEMISTRY DEGREE PROGRAMS

The strongest background includes Honors Chemistry (CHM 040 & 041) and the higher level Mathematics and Physics courses. The sequence below illustrates one pathway to achieve all required courses in the proper sequence. While the schedule below is ideal, MANY students start with different courses in their first year. It is possible to change into a B.S. in Chemistry degree program in a later semester, but consultation with a Major Advisor will be required. If a B.S. in Chemistry degree program is one of your options, stay in the MATH 21, 22, 23 sequence, and take Physics 11 and 21 instead of the "lower level" sequences (MATH 51&52, Physics 10&13).

First Year	CR
College Seminar	3-4
CHM 040	4
CHM 041	4
MATH 021	4
MATH 022	4
PHY 011	4
PHY 012	1
WRT 001	3
WRT 002	3
	30-31

Second Year	CR
CHM 110 & CHM 111	4
CHM 112 & CHM 113	4
PHY 021 & PHY 022	5
MATH 023	4
MATH 043	3
ENGR 010 or CSE 012	2
distribution requirements - free electives	9
	31

Total Credits: 61-62

Note that some concentrations would insert courses such as MATH 012, BIOS 041/BIOS 042 (B.S. Pharmaceutical Chemistry or B.S. in Biochemistry), etc., which may require moving some courses to later years. The non-B.S. in Chemistry degree programs can substitute the lower level MATH and PHYSICS courses as well.

junior year/senior year (30-32 credits each year)

Each student will need to meet with a Major Advisor in order to formulate the courses to be taken. There are a couple of sequencing issues, but if the full year of organic chemistry has been completed by the Fall of the third year, then the last two years are relatively easy to schedule to complete all required courses. Even if organic chemistry has not been completed by then, it is possible to complete everything in the remaining two years, but the course sequences becomes almost fixed in terms of when each course is taken.

MODEL ROSTER WHEN PATH B IS FOLLOWED - PHARMACEUTICAL CHEMISTRY AND BIOCHEMISTRY

First Year	CR
College Seminar	3-4
CHM 040	4
CHM 041	4
MATH 051	4
MATH 052	3
PHY 010	4
PHY 012	1
WRT 001	3
WRT 002	3
	29-30

Second Year	CR
CHM 110 & CHM 111	4
CHM 112 & CHM 113	4
PHY 013 & PHY 022	4
MATH 043	3
distribution requirements - free electives	15
	30

Total Credits: 59-60

Note that some concentrations would insert courses such as MATH 012, BIOS 041/BIOS 042(B.S. Pharmaceutical Chemistry or B.S. in Biochemistry), etc., which may require moving some courses to later years. The non-B.S. in chemistry degree programs can substitute the lower level MATH and PHYSICS courses.

junior year/senior year (30-32 credits EACH YEAR)

Each student will need to meet with a Major Advisor in order to formulate the courses to be taken. There a couple of sequencing issues, but if the full year of organic chemistry has been completed by the Fall of the third year, then the last two years are relatively easy to schedule to complete all required courses.

B.S. DEGREE IN CHEMISTRY, COLLEGE OF ENGINEERING & APPLIED SCIENCE

Summary of Requirements

The Chemistry and collateral courses for the ACS Certified Degree in Chemistry is identical in both colleges, in terms of the specific courses required. The B.S. in Chemistry degree in the Rossin College of Engineering and Applied Sciences requires both the higher level MATH and PHYSICS courses (MATH 21, 22, & 23, PHYS 11 & 21) but the college distribution requirements are a little different from those in the College of Arts and Sciences.

College distribution	24
Physics, math, and computing	28
Chemistry	46
Unrestricted electives	25
Total Credits	**123**

CHM 040 or CHM 030	Honors General Chemistry I Introduction to Chemical Principles	4
CHM 041 or CHM 031	Honors General Chemistry II Chemical Equilibria in Aqueous Systems	4
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 112 & CHM 113	Organic Chemistry II and Organic Chemistry Laboratory II	4
CHM 307	Advanced Inorganic Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 334	Advanced Chemistry Laboratory I	3
CHM 335	Advanced Chemistry Laboratory II	3
CHM 341	Molecular Structure, Bonding and Dynamics	3
CHM 342	Thermodynamics & Kinetics	3
CHM 343	Physical Chemistry Laboratory	2
CHM 351	Professional Development Seminar	2
CHM 371	Elements of Biochemistry I	3
CHM 375	Research Chemistry Laboratory	2
Advanced Chemistry Elective Requirement		
Select one course from two of the three areas listed below:		6
Analytical Chemistry (CHM 350) [1]		
CHM 336	Clinical Chemistry	
CHM 356	Spectral Analysis	
CHM 388	Polymer Characterization	
Biochemistry (CHM 350) [1]		
CHM 323	Chemical Biology	
CHM 362	Molecular Biophysics	
CHM 365	Protein Separation & Biophysical Analysis	
CHM 372	Elements of Biochemistry II	
CHM 373	Lipids and Membranes	
Inorganic Chemistry (CHM 350) [1]		
CHM 305	Organometallic Chemistry	
CHM 337	Crystallography and Diffraction	
CHM 340	Solid-State Chemistry	
CHM 364	Bioinorganic Chemistry	
Collateral Requirements		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
Select one from the following:		2-4
ENGR 010	Applied Engineering Computer Methods	
CSE 003	Introduction to Programming, Part A	
CSE 007	Introduction to Programming	
Total Credits		**76-78**

[1]

CHM 350 may be applied to any one of the three areas, provided it is for a 3 credit lecture course and the particular section has been identified to fit into one of these three areas based on course content. CHM 350 may be repeated for credit if a different topic is offered, and if appropriate, a second CHM 350 section may count under a different area.

ACCELERATED COMBINED B.S. - M.S. DEGREE OPTIONS IN CHEMISTRY

Individual degree paths can be designed to earn either the B.S. or both BS. and M.S. degrees in Chemistry over a reduced or accelerated time frame. A discussion with the Chemistry faculty advisor during the first academic year is required to successfully complete any of the following options:

1. If you have more than 20 credits total of AP or transfer courses, it may be possible to earn the B.S. in three years and the M.S. in four. This path may require up to two summers of courses and/or research for most students.
2. If you have 30 or more AP or transfer credits, then it may be possible to be supported as a Teaching Assistant or Research

Assistant during the fourth year as a graduate student to finish the M.S. degree, although such support is not guaranteed. The B.S. degree must be completed in three years, and up to two summers of courses and/or research may be required.

3. If you have limited or no AP or transfer credits, then two paths are available: A) A five year path is possible with one summer of research work after the B.S. degree is finished in four years. B) A five year path with support during the fifth year as a TA or RA may be possible if courses are excluded from the undergraduate degree (possibly requiring course overloads), and one summer of research is generally required, but support is not guaranteed.

Accelerated B.S. degree options are also possible for some students. See the Chemistry faculty advisor to develop a customized program for your situation. A discussion as early as possible is best for determining which options may be suitable.

B.S. IN BIOCHEMISTRY

An interdepartmental B.S. in Biochemistry major is offered in the College of Arts and Sciences. Faculty in both Chemistry (Glover, and Thévenin) and Biological Sciences (Lowe-Krentz, Iovine and Behe) serve as advisors depending on student interest. Please see the section on Biochemistry (p. 87) for details of the major.

MINOR IN CHEMISTRY

A minor in chemistry may be achieved by completing the following requirements:

CHM 031	Chemical Equilibria in Aqueous Systems [1]	4
or CHM 041	Honors General Chemistry II	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
CHM 332	Analytical Chemistry	3
CHM 342	Thermodynamics & Kinetics [2]	3
CHM 343	Physical Chemistry Laboratory [3]	2
Total Credits		**16**

1 Prerequisite of (CHM 030 or CHM 040) and corequisite of (MATH 21 or MATH 31 or MATH 51 or MATH 76)

2. Prerequisites of (CHM 031 or CHM 041) and MATH 021 or MATH 51) and (MATH 022 or MATH 32 or MATH 52) and (PHY 013 or PHY 021).

3. Prerequisite of CHM 342.

4. Students who wish to minor in chemistry but whose major program requires more than one of the above courses may achieve the minor with substitutions approved by the department chair.

GRADUATE PROGRAMS IN CHEMISTRY

The Department of Chemistry offers graduate studies leading to two advanced degrees. Doctor of philosophy degrees in Chemistry and in Polymer science and engineering may be obtained by study and research in any appropriate area of chemistry.

The following information on admissions, proficiency examinations and other policies applies to doctor of philosophy degrees in chemistry.

Admission to graduate study in chemistry assumes that a student has met, or is willing to meet though further study, minimum undergraduate requirements for a bachelor's degree in chemistry. This would include (beyond two semesters of introductory chemistry) two semesters of organic chemistry, two semesters of physical chemistry, two semesters of analytical chemistry and one semester of inorganic chemistry. A promising student whose degree is in a field related to chemistry (e.g., biology, chemical engineering) may be admitted to graduate study in chemistry provided that any deficiencies in basic chemistry preparation are made up in the first year of graduate study, noting that some of the courses required for this may not carry graduate credit.

The Chemistry Department administers proficiency examinations at the undergraduate level upon matriculation to Lehigh. Information on the examinations will be sent to each student several months in advance of matriculation. It is expected that each student will prepare diligently for these tests. A Ph.D. candidate must show proficiency in the areas tested. An incoming student who fails one or more of the examinations will have two additional opportunities to demonstrate proficiency by re-taking the examination(s). The student is highly encouraged to meet with the Graduate Advising Director to determine the best course of action in light of the exam performance and projected area of study. The student may prepare for the examination(s) by self-study and/or enrolling in or auditing of appropriate courses, and is strongly encouraged to seek faculty advice on preparing to retake any exam.

Doctor of Philosophy Degree

Completion of a doctor of philosophy degree program normally requires a minimum of four years of full time work after entrance with a bachelor's degree. There are few specific course credit requirements for the Ph.D.; however, approved degree programs generally have at least 26 hours of course work. A minimum of 15 credits must be obtained in the Department of Chemistry. Thus, the program consists of approximately one-third formal course work and two-thirds independent study and research. There is a one-credit seminar requirement (CHM 481). After Ph.D. proficiency has been established and the research advisor selected (this must be done by the end of the first semester in residence), the major hurdle is the general doctoral examination in the student's area of concentration. This exam must be passed by the end of 2 1/2 years of residence. If this hurdle is surmounted, the remaining time is spent completing (and ultimately defending) the dissertation research under the guidance of the research advisor and the dissertation committee.

Chemistry, PhD

Course Work		18
CHM 421	Chemistry Research	6
CHM 481	Chemistry Seminar	1
Total Credits [1]		26

1

A minimum of 15 credits must be obtained in the Department of Chemistry.

CURRENT RESEARCH PROJECTS

Current research projects of interest are listed below.

Analytical Chemistry

Biosensors; microfluidic platforms; electroanalytical chemistry.

Biochemistry

Membrane protein interactions; structural characterization of membrane proteins; production of membrane proteins; biophysical characterization of membrane proteins; biomaterials; multi-drug resistance; selective drug delivery; anti-cancer therapy; antibiotic drug discovery; cell surface remodeling; immunotherapy; activity based probes; fluorescence assay development.

Inorganic Chemistry

Synthesis, characterization, and reactivity of transition metal complexes and nano particles; coordination chemistry and molecular self-assembly at metal surfaces and semi-metal surfaces; electrochemistry at metal, semi-metal, and oxide-coated electrodes; synthesis and characterization of mesoporous solids from transition metal and main-group element precursors; applications of mesoporous solids for carbon sequestration; formation of multilayered thin films of inorganic and organic-inorganic hybrid materials; and application of lanthanide catalysis in organic synthesis.

Materials and Polymer Chemistry

Inorganic and organometallic chemistry in the synthesis of thin-film materials; synthesis at and dynamics of polymer interfaces; acoustic, optical, permeability, dielectric and mechanical behavior of thin films; laser light scattering and small-angle X-ray scattering studies on polymer solutions; polyelectrolytes and ion-containing solutions; nanofabrications in polymer systems; organic-inorganic hybrid solid state materials; synthesis and characterization of novel mesoporous materials; characterization of semiconducting material

Organic Chemistry
Chemical models for biochemical reactions; chemistry of monolayers and organized molecule assemblages; drug carriers; synthetic ion conductors; organometallic reaction mechanisms; organofluorine chemistry; protein folding and renaturation; molecular recognition; calorimetry; electrochemical studies of electron transfer reactions; synthetic methods development.

Physical Chemistry
Chemistry at surfaces and interfaces of polymers, electrodes, thin films, and biosensors using an array of surface sensitive methods: spectroscopic ellipsometry, scanning probe microscopy, angle resolved X-ray photo electron spectroscopy, electrochemistry, and quartz crystal microbalance; nanomechanics; intermolecular interactions in soft matter; single-molecule force spectroscopy; chemically sensitive imaging at nanoscale; development of optics-based tools for chemical analysis; femtosecond ultra-fast spectroscopy; investigation of charge transfer in energy materials; spectroscopy; transient absorption spectroscopy; time-resolved photoluminescence; proton-coupled electron transfer reactions.

Major Instrumentation
Chemistry research spans all areas: analytical, biochemistry, inorganic, organic, and physical. Special equipment available for graduate research in chemistry is as follows.

Research facilities
GC-MS, MALDI-TOF-MS, HPLCs, GCs, ultracentrifuges, cold rooms, cell disintegrator, zone and disc electrophoresis apparatus, column chromatograph, autoclave, freezers (-80C), rotary vaporator, Milli-Q water purification system, shaking heated water baths, spectropolarimeter with circular dichroism capability. Cell culture facilities – complete with optical microscopes having fluorescent and photographic capabilities. Electron optical facilities – transmission electron microscopy with x-ray fluorescence analysis capability, scanning electron microscope, and scanning electron microprobe. Gas chromatographs. Liquid chromatographs – high performance for analytical and preparative work. NMR spectrometers – 400 MHz for both solids and solutions, and 500 MHz for solutions with an enhanced sensitivity multinuclear cryoprobe. Photochemistry equipment – lamps and filters for selected wavelength work. Polarographs, chronopotentiometers, electrophoresis apparatus, electrochemical impedance, electrochemical scanning tunneling microscope, potentiostats, and rotating disk electrode. Portable data interface (8-channel 50 KHz), digital readout polarimeter, Vibron elastoviscometers, differential refractometer.

Spectrometers
UV/visible double beam automated, fluorescence, UV/visible/near IR, Fourier transform IR with diffuse reflectance, photoacoustic and attenuated reflectance capability, and GC mass spectrometers. Surface analysis facilities – rotating anode high-sensitivity high-energy resolution ESCA with imaging capability (ESCA is equipped with automated angular data acquisition). Surface science facility – Low energy electron diffraction (LEED), photocorrelation spectroscopy for submicron particle analysis. Ellipsometer, contact angle capabilities, gas adsorption apparatus (BET), atomic force microscope, instructional scanning tunneling microscope, and light scanning. Microcalorimeter (flowing with UV and refractive index detectors), differential scanning calorimeter (DSC).

Courses

CHM 030 Introduction to Chemical Principles 0,4 Credits
An introduction to important topics in chemistry: atomic structure, properties of matter, chemical reactions, energy, structure and bonding in organic and inorganic compounds. The course features a lecture tightly linked to a three-hour studio experience that combines laboratory work and recitation.
Attribute/Distribution: LS, NS, NW, Q

CHM 031 Chemical Equilibria in Aqueous Systems 0,4 Credits
An introduction to: intermolecular forces and their influence on physical properties and phase behavior; chemical kinetics; thermodynamics in chemical systems; and electrochemistry. The course includes a detailed treatment of equilibria in aqueous solutions, including acid-base, precipitation-solubility, metal-ligand, oxidation-reduction and distribution equilibria. The laboratory work emphasizes the qualitative and quantitative analysis of equilibria in aqueous media. Three lectures and one three-hour laboratory period.
Prerequisites: (CHM 030 or CHM 040) and (MATH 021 or MATH 031 or MATH 051 or MATH 076)
Attribute/Distribution: NS, NW, Q

CHM 040 Honors General Chemistry I 0,4 Credits
A first-semester course in chemistry for students planning to major in chemistry, biochemistry, chemical engineering, materials science, or other chemistry-related fields. Chemical and physical properties, structures, bonding concepts, and quantitative analysis. Laboratory includes synthesis, separation and analysis procedures; computer applications to chemistry. Three lectures and one three-hour laboratory period.
Attribute/Distribution: NS, NW, Q

CHM 041 Honors General Chemistry II 0,4 Credits
Continuation of Chemistry 40. Three lectures and one three-hour laboratory period.
Prerequisites: (CHM 040 or CHM 030) and (MATH 021 or MATH 031 or MATH 051 or MATH 075)
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 075
Attribute/Distribution: NS, NW, Q

CHM 110 Organic Chemistry I 0,3 Credits
Systematic survey of the typical compounds of carbon, their classification, and general relations; study of synthetic reactions.
Prerequisites: CHM 031 or CHM 041
Attribute/Distribution: NS

CHM 111 Organic Chemistry Laboratory I 1 Credit
Preparation of pure organic compounds. Modern techniques of characterization.
Prerequisites: CHM 031 or CHM 041 or CHM 110
Can be taken Concurrently: CHM 110
Attribute/Distribution: NS, Q

CHM 112 Organic Chemistry II 0,3 Credits
Continuation of CHM 110.
Prerequisites: CHM 031 or CHM 041 or CHM 110
Attribute/Distribution: NS

CHM 113 Organic Chemistry Laboratory II 1 Credit
Continuation of Organic Chemistry Laboratory I.
Prerequisites: CHM 030 or CHM 040 and (CHM 031 or CHM 041 or CHM 110) and CHM 112
Can be taken Concurrently: CHM 112
Attribute/Distribution: NS, Q

CHM 177 Introduction to Research 1-2 Credits
For advanced freshmen and sophomore chemistry majors. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, NW, Q

CHM 194 Physical Chemistry for Biological Sciences 3 Credits
The principles and applications of physical chemical concepts to systems of biological interest, including the gas laws, thermodynamics of metabolic reactions, colligative properties, electrochemical equilibria, reaction kinetics and enzyme catalysis, and transport of macromolecules and viruses.
Prerequisites: (CHM 030 or CHM 040) and (CHM 031 or CHM 041)
Attribute/Distribution: NS, Q

CHM 250 Special Topics 1-4 Credits
Selected topics in chemistry. Consent of instructor required.
Repeat Status: Course may be repeated.

CHM 300 Apprentice Teaching 3 Credits
Consent of instructor required.
Repeat Status: Course may be repeated.

CHM 305 Organometallic Chemistry 3 Credits
The chemistry of compounds containing bonds between carbon and the transition metals. Topics include the synthesis, characterization, and electronic structure of organometallic compounds, and mechanistic studies of their reactions. A description of common ligands and their bonding is covered, as well as applications of organometallic chemistry in organic synthesis and catalysis.
Prerequisites: CHM 112
Attribute/Distribution: NS

CHM 307 Advanced Inorganic Chemistry 3 Credits
Introduction to transition metal complexes; theories of bonding; kinetics and mechanisms of transition metal complex reactions; and selected aspects of organometallic chemistry. .
Prerequisites: CHM 031 or CHM 041
Attribute/Distribution: NS, NW, Q

CHM 323 Chemical Biology 3 Credits
Chemical biology is a discipline at the interface of organic and biological chemistry. It entails the design, synthesis, and evaluation of probes, substrates, and materials for the study of biological systems using chemical principles. Chemical biology can also take inspiration from biological systems for the design and synthesis of novel molecules and materials for non-biological applications. The class is designed to be an introduction to chemical biology for upper-level undergraduates and graduate students.
Prerequisites: CHM 112 and (BIOS 371 or CHM 371)

CHM 332 Analytical Chemistry 3 Credits
Theory and practice of chemical analysis. Principles of quantitative separations and determinations; theory and application of selected optical and electrical instruments in analytical chemistry; interpretation of numerical data, design of experiments, solute distribution in separation methods.
Prerequisites: (CHM 031 or CHM 041) and CHM 110
Attribute/Distribution: NS, Q

CHM 334 Advanced Chemistry Laboratory I 0,3 Credits
Exploration of synthetic methods and analysis techniques for inorganic and organic compounds. Determination of product structures and quantitative analysis using modern chemical analysis techniques, including NMR, GC-MS, GC, HPLC, FT-IR, and Electrochemistry.
Prerequisites: (CHM 110 and CHM 111 and CHM 112 and CHM 113 and CHM 332)
Can be taken Concurrently: CHM 332
Attribute/Distribution: Q, W

CHM 335 Advanced Chemistry Laboratory II 0,3 Credits
Continuation of CHM 334.
Prerequisites: (CHM 334)
Attribute/Distribution: Q, W

CHM 336 Clinical Chemistry 3 Credits
Applications of analytical chemistry to clinical problems. Discussion of methods in common use and the biochemical/medical significance of the results.
Prerequisites: CHM 031 or CHM 041 or CHM 332 or CHM 112
Attribute/Distribution: NS, Q

CHM 337 Crystallography and Diffraction 3 Credits
Introduction to crystal symmetry, point groups, and space groups. Emphasis on materials characterization by Xray diffraction and electron diffraction. Specific topics include crystallographic notation, stereographic projections, orientation of single crystals, textures, phase identification, quantitative analysis, stress measurement, electron diffraction, ring and spot patterns, convergent beam electron diffraction (CBED), and space group determination. Applications in mineralogy, metallurgy, ceramics, microelectronics, polymers, and catalysts. Lectures and laboratory work. Prerequisites may be waived if student has senior standing in chemistry.
Prerequisites: CHM 031 or CHM 041 or MAT 203 or EES 131
Attribute/Distribution: NS

CHM 340 Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nanoporous solids.
Prerequisites: CHM 031 or CHM 041
Attribute/Distribution: NS, NW, Q

CHM 341 Molecular Structure, Bonding and Dynamics 3 Credits
Nature of chemical bonding as related to structure and properties of molecules and extended systems. Quantum chemistry of atoms and molecules applied to chemical transformations and spectroscopic transitions. Symmetry analysis and selections rules. Interpretation of electronic, vibrational and rotational spectra.
Prerequisites: (MATH 023 or MATH 033) and (PHY 021 or PHY 013) and (CHM 031 or CHM 041)
Attribute/Distribution: NS, Q

CHM 342 Thermodynamics & Kinetics 3 Credits
Development of the principles of classical and statistical thermodynamics and their application to chemical systems. In classical thermodynamics emphasis will be on systems in which composition is of major concern: solutions, chemical and phase equilibria. Kinetic theory of gases; chemical reaction kinetics; chemical reaction dynamics.
Prerequisites: (CHM 031 or CHM 041) and (PHY 013 or PHY 021) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: Q

CHM 343 Physical Chemistry Laboratory 2 Credits
Laboratory studies that illustrate and extend the various fields of study in experimental physical chemistry as discussed in CHM 341 and CHM 342. This course fulfills the junior year writing intensive course requirement in CAS.
Prerequisites: CHM 194 or CHE 210 or CHM 342
Attribute/Distribution: NS, W, WRIT

CHM 346 Photochemistry of Consequence 3 Credits
Photochemistry involves using photons (light from the sun) to drive critical chemical reactions and is attractive because of its application to solar energy. Fundamental processes in photochemistry will be covered . Topics will include: energy transfer, electron transfer, proton-coupled electron transfer processes and their applications to biological systems.
Prerequisites: CHM 031 or CHM 041
Attribute/Distribution: NS

CHM 350 Special Topics 1-3 Credits
Selected advanced topics in chemistry.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

CHM 351 Professional Development Seminar 2 Credits
Topics for the developing professional chemist include lab safety, using a laboratory notebook, searching the scientific literature, reading and writing scientific papers, ethics, and developing both a poster and an oral presentation. Students will present their own poster and a short talk on the same subject. Each student will write his/her own resume and participate in a mock interview session.
Attribute/Distribution: NS

CHM 356 Spectral Analysis 3 Credits
Use of data from nuclear magnetic residence, infrared, ultraviolet, and mass spectrometric techniques for the determination of structure of organic compounds. Emphasis on information from one- and two-dimensional proton and carbon NMR, and a mechanistic interpretation of data from mass spectrometry.
Prerequisites: CHM 112

CHM 357 Organic Reaction Mechanisms 3 Credits
Intensive in class problem solving that involves the formulation of reasonable reaction mechanisms for complex multistep pathways, i.e. organic transformations that proceed via highly energetic intermediates such as carbocations, carbanions, free radicals, carbenes, and nitrenes.
Prerequisites: CHM 112

CHM 358 Advanced Organic Chemistry 3 Credits
Reaction mechanism types and supporting physical-chemical data. Classes of mechanisms include elimination, substitution, rearrangement, oxidation-reduction, enolate alkylations, and others. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

CHM 362 Molecular Biophysics 3 Credits
This course focuses on the physical tools that exist to obtain information about biological macromolecules, with an emphasis on spectroscopic and imaging techniques (e.g., circular dichroism, fluorescence spectroscopy, FRET, BRET, calorimetry, analytical ultracentrifugation, X-ray crystallography, electron microscopy, dynamic light scattering, surface plasmon resonance). Lectures and discussion of research articles are used to illustrate the use of the different tools and methods.
Prerequisites: BIOS 371 or CHM 371
Attribute/Distribution: NS

CHM 364 Bioinorganic Chemistry 3 Credits
This course will cover inorganic chemistry as it relates to biology, with emphasis on how metal ions and cofactors are employed by biological systems. Topics will include metalloproteins, metal cofactors, and metals in medicine. Experimental methods used to study bioinorganic chemistry will also be discussed.
Prerequisites: CHM 371 or BIOS 371
Attribute/Distribution: NS

CHM 365 Protein Separation & Biophysical Analysis 3 Credits
Laboratory studies of techniques and principles used for the isolation, characterization, and biophysical analysis of proteins.
Prerequisites: BIOS 371 or CHM 371
Attribute/Distribution: NS

CHM 371 (BIOS 371) Elements of Biochemistry I 0,3 Credits
A general study of carbohydrates, proteins, lipids, nucleic acids and other biological substances and their importance in life processes. Protein and enzyme chemistry are emphasized. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

CHM 372 (BIOS 372) Elements of Biochemistry II 3 Credits
Dynamic aspects of biochemistry: enzyme reactions including energetics, kinetics and mechanisms, metabolism of carbohydrates, lipids, proteins and nucleic acids, photosynthesis, electron transport mechanisms, coupled reactions, phosphorylations, and the synthesis of biological macromolecules.
Prerequisites: BIOS 473 or ((BIOS 371 or CHM 371) and BIOS 041)
Attribute/Distribution: NS

CHM 373 Lipids and Membranes 3 Credits
The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.
Prerequisites: BIOS 372 or CHM 372
Attribute/Distribution: NS

CHM 375 Research Chemistry Laboratory 1-3 Credits
An introduction to independent study or laboratory investigation under faculty guidance. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, Q

CHM 376 Advanced Research Chemistry Laboratory 1-6 Credits
Advanced independent study or laboratory investigation under faculty guidance. Consent of faculty research supervisor.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, Q

CHM 377 (BIOS 377) Biochemistry Laboratory 0,3 Credits
Laboratory studies of the properties of chemicals of biological origin and the influence of chemical and physical factors on these properties. Laboratory techniques used for the isolation and identification of biochemicals.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 031 or BIOS 041)
Can be taken Concurrently: BIOS 371, CHM 371
Attribute/Distribution: NS

CHM 388 (CHE 388, MAT 388) Polymer Characterization 3 Credits
Description of molecular weight measurements using dilute solutions (solution viscosity, size exclusion chromatography, osmotic pressure, and light scattering). Introduction to polymer thermal analysis techniques such as differential scanning calorimetry (DSC) , dynamic mechanical analysis (DMA), and thermomechanical analyzer (TMA). Discussion of structure and morphology of polymers and polymer blends using nuclear magnetic resonance (NMR), infrared spectroscopy (IR), Raman spectroscopy, UV analysis, transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM). Crystallinity measurements using SANS, SAXS, and WAXS.
Prerequisites: MAT 033 or MAT 204 or MAT 392 or MAT 393

CHM 389 Honors Project 1-6 Credits
Opportunity for Chemistry majors to pursue an Honors Project. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q, W

CHM 391 (CHE 391) Colloid and Surface Chemistry 3 Credits
Physical chemistry of everyday phenomena. Intermolecular forces and electrostatic phenomena at interfaces, boundary tensions and films at interfaces, mass and charge transport in colloidal suspensions, electrostatic and London forces in disperse systems, gas adsorption and heterogeneous catalysis.
Prerequisites: CHM 342
Attribute/Distribution: NS

CHM 393 (CHE 393, MAT 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single- and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT.

CHM 394 (CHE 394) Organic Polymer Science I 3 Credits
Organic chemistry of synthetic high polymers. Polymer nomenclature, properties, and applications. Functionality and reactivity or monomers and polymers. Mechanism and kinetics of step-growth and chain-growth polymerization in homogenous and heterogenous media. Brief description of emulsion polymerization, ionic polymerization, and copolymerization. Must have completed one year of physical chemistry and one year of organic chemistry.
Prerequisites: CHM 031 or CHM 041 or CHM 110 or CHM 112 or CHM 342 or CHE 210
Attribute/Distribution: NS, Q

CHM 400 First Year Graduate Student Seminar 0 Credits
First year graduate student seminar course and introduction to research. Topics include: research opportunities in the department, introduction to instrumentation facilities, ethics in science, use of library facilities, effective teaching methods. Course may be repeated.
Repeat Status: Course may be repeated.

CHM 405 Organometallic Chemistry 3 Credits
The chemistry of compounds containing bonds between carbon and the transition metals. Topics include the synthesis, characterization, and electronic structure of organometallic compounds, and mechanistic studies of their reactions. A description of common ligands and their bonding is covered, as well as applications of organnometallic chemistry in organic synthesis and catalysis.

CHM 407 Advanced Inorganic Chemistry 3 Credits
Introduction to transition metal complexes; theories of bonding; kinetics and mechanisms of transition metal complex reactions; and selected aspects of organometallic chemistry. Must have completed one semester of physical chemistry and have CAS graduate student status.

CHM 421 Chemistry Research 1-6 Credits
Research in one of the following fields of chemistry: analytical, inorganic, organic, physical, polymer, biochemistry. A maximum of 6 credits total may be earned. Consent of the instructor is required.
Repeat Status: Course may be repeated.

CHM 423 Chemical Biology 3 Credits
Chemical biology is a discipline at the interface of organic and biological chemistry. It entails the design, synthesis, and evaluation of probes, substrates, and materials for the study of biological systems using chemical principles. Chemical biology can also take inspiration from biological systems for the design and synthesis of novel molecules and materials for non-biological applications. The class is designed to be an introduction to chemical biology for upper-level undergraduates and graduate students.

CHM 426 Statistical Thermodynamics 3 Credits
Principles and applications of statistical mechanics to chemical problems. A study of the techniques for evaluating the properties of matter in bulk from the properties of molecules and their interactions.

CHM 427 Thermodynamics & Kinetics 3 Credits
Development of the principles of classical and statistical thermodynamics and their applications to chemical systems. In classical thermodynamics, emphasis will be on systems in which composition is of major concern: solutions, chemical and phase equilibria. Kinetic theory of gases; chemical reaction kinetics. Must have CAS graduate student status. This course cannot be taken by students who have already taken CHM 342.

CHM 434 Advanced Topics in Spectroscopy 3 Credits
Fundamentals of interactions of electromagnetic radiation with matter: electronic, vibrational, scattering based spectroscopies, instrumentation and signal processing. Advanced applications to the analysis of molecular structure and chemical processes including surface analysis, time-resolved spectroscopies, and ultrasensitive spectroscopic techniques.

CHM 436 Special Topics in Analytical Chemistry 1-3 Credits
Topics of contemporary interest in analytical chemistry.
Repeat Status: Course may be repeated.

CHM 438 Analytical Chemistry 3 Credits
Theory and practice of chemical analysis. Principles of quantitative separations and determinations; theory and application of selected optical and electrical instruments in analytical chemistry; interpretation of numerical data; design of experiments; solute distribution in separation methods. Must have CAS graduate student status.

CHM 443 (MAT 443) Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nonoporous solids.

CHM 444 Molecular Structure, Bonding and Dynamics 0,3 Credits
Nature of chemical bonding as related to structure and properties of molecules and extended systems. Quantum chemistry of atoms and molecules applied to chemical transformations and spectroscopic transitions. Symmetry analysis and selections rules. Interpretation of electronic, vibrational and rotational spectra. Must have CAS graduate student status.

CHM 446 Photochemistry of Consequence 3 Credits
Photochemistry involves using photons (light from the sun) to drive critical chemical reactions and is attractive because of its application to solar energy. Fundamental processes in photochemistry will be covered. Topics will include: energy transfer, electron transfer, proton-coupled electron transfer processes and their applications to biological systems.

CHM 452 Advanced Organic Chemistry 3 Credits
Reaction mechanism types and supporting physical chemical data. Classes of mechanisms include elimination, substitution, rearrangement, oxidation reduction, enolate alkylations, and others. Must have completed one year of organic chemistry and have CAS graduate student status.

CHM 453 Heterocyclic Compounds 3 Credits
An intensive study of the syntheses, reactions and properties of heteroaromatic compounds including derivatives of thiophene, pyrrole, furan, indole, pyridine, quinoline, the azoles and the diazines all considered from the viewpoint of modern theories of structure and reaction mechanisms.
Prerequisites: CHM 358 or CHM 452

CHM 455 Organic Reactions 3 Credits
Intensive survey of modern synthetic organic chemistry from a mechanistic standpoint. Classical Namereactions, olefin synthesis, organometallic reagents in synthesis, Woodward-Hoffmann rules, electrocyclic processes, enolate chemistry, and related reactions.
Prerequisites: or CHM 452, CHM 358 or CHM 452

CHM 456 Spectral Analysis 3 Credits
Use of data from nuclear magnetic resonance, infrared, ultraviolet, and mass spectrometric techniques for the determination of structure of organic compounds. Emphasis on information from one- and two-dimensional proton and carbon NMR, and a mechanistic interpretation of data from mass spectrometry.

CHM 457 Organic Reaction Mechanisms 3 Credits
Intensive in class problem solving that involves the formulation of reasonable reaction mechanisms for complex multistep pathways, i.e. organic transformations that proceed via highly energetic intermediates such as carbocations, carbanions, free radicals, carbenes, and nitrenes.

CHM 458 Topics in Organic Chemistry 1-3 Credits
An intensive study of limited areas in organic chemistry.
Repeat Status: Course may be repeated.

CHM 462 3 Credits
This course focuses on the physical tools that exist to obtain information about biological macromolecules, with an emphasis on spectroscopic and imaging techniques (e.g., circular dichroism, fluorescence spectroscopy, FRET, BRET, calorimetry, analytical ultracentrifugation, X-ray crystallography, electron microscopy, dynamic light scattering, surface plasmon resonance). Lectures and discussion of research articles are used to illustrate the use of the different tools and methods.

CHM 464 Bioinorganic Chemistry 3 Credits
This course will cover inorganic chemistry as it relates to biology, with emphasis on how metal ions and cofactors are employed by biological systems. Topics will include metalloproteins, metal cofactors, and metals in medicine. Experimental methods used to study bioinorganic chemistry will also be discussed.

CHM 465 Protein Separation & Biophysical Analysis 3 Credits
Laboratory studies of techniques and principles used for the isolation, characterization, and biophysical analysis of proteins.
Attribute/Distribution: NS

CHM 472 (BIOS 472) Lipids and Membranes 3 Credits
The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.
Prerequisites: BIOS 372 or CHM 372

CHM 473 (BIOS 473) Principles of Biochemistry I 3 Credits
Study of proteins, carbohydrates, lipids, nucleic acids and other biological substances. Protein and enzyme chemistry are emphasized. Must have completed one year each of general chemistry and organic chemistry.

CHM 475 Advanced Topics in Chemistry 1 Credit
Audiovisual courses in topics such as acid-base theory, NMR, chromatography, electroanalytical chemistry and mass-spectroscopy interpretation; course material obtained from the American Chemical Society.
Repeat Status: Course may be repeated.

CHM 477 (BIOS 477) Topics In Biochemistry 1-3 Credits
Selected areas of biochemistry, such as mechanisms of enzyme action, new developments in the chemistry of lipids, nucleic acids, carbohydrates and proteins. Must have completed one semester of biochemistry.
Repeat Status: Course may be repeated.

CHM 481 Chemistry Seminar 1 Credit
Student presentations on current research topics in the student's discipline but not on subjects close to the thesis. A one-hour presentation and attendance at other presentations are required for credit.
Repeat Status: Course may be repeated.

CHM 482 (CHE 482, MAT 482) Mechanical Behaviors of Polymers 3 Credits
Mechanical behavior of polymers. Characterization of experimentally observed viscoelastic response of polymeric solids with the aid of mechanical model analogs. Topics include time-temperature superposition, experimental characterization of large deformation and fracture processes, polymer adhesion, and the effects of fillers, plasticizer, moisture, and aging on mechanicial behavior.

CHM 483 (CHE 483, MAT 483) Emulsion Polymers 3 Credits
Fundamental concepts important in manufacture, characterization, and application of polymer latexes. Topics include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

CHM 485 (CHE 485, MAT 485) Polymer Blends 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends. Polymer/polymer miscibility and thermodynamics of mixing of polymer/solvent and polymer/polymer blends. Prediction of miscibility using various theoretical models and methods that can be used to help enhance miscibility (H bonding etc.). Methods to enhance the compatibility of polymer/polymer blends (e.g., block copolymers, ternary addition, IPNs), etc.). Types of polymer blends. Must have completed any introductory polymer course or equivalent.

CHM 487 Topics in Colloid and Surface Chemistry 3 Credits
Applications of colloid chemistry; special topics in surface chemistry. Lectures and seminar.
Repeat Status: Course may be repeated.

CHM 488 Advanced Topics in Physical Chemistry 1-3 Credits
Advanced topics in physical chemistry, such as photochemistry and molecular beam dynamics, Fourier transform spectroscopy, kinetics of rapid reactions, theory of magnetic resonance, liquids and solutions. Topic changes almost every time it is offered.
Repeat Status: Course may be repeated.

CHM 489 Organic Polymer Science II 3 Credits
Continuation of CHM 394. Theory and mechanism of ionic vinyladdition chaingrowth polymerization. Chain copolymerization by radical and ionic mechanism. Mechanism of ring-opening polymerization, stereochemistry of polymerization including ionic, coordination, and Ziegler-Natta mechanisms. Reactions of polymers, including crosslinking, reaction of functional groups, graft and block copolymers, and polymer carriers and supports.

CHM 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

CHM 492 (CHE 492, MAT 492) Topics in Polymer Science 3 Credits
Intensive study of topics selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtownian flow behavior, second-order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.

CHM 494 Quantum Chemistry 3 Credits
Principles and applications of quantum mechanics to chemical problems. Applications to chemical bonding, molecular structure, reactivity and spectroscopy.

CHM 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Cognitive Science

Website: http://cogsci.cas.lehigh.edu/ **(**http://cogsci.cas2.lehigh.edu/**)**

The mission of the Cognitive Science Program is to advance the study of minds and brains, real or artificial, in all their aspects, through research and teaching. This interdisciplinary field, encompassing the fields of psychology, linguistics, computer science, philosophy, anthropology, and neuroscience, provides excellent preparation for life in the age of information. The program aims to instill in students a solid grasp of the intellectual problems, frameworks, and methodologies currently available; to provide experience exploring these through guided research; and to foster the desire to create and disseminate new knowledge. With this foundation, students are well prepared for a wide variety of careers at the interfaces of technology, minds, brains, and behavior, and for graduate study in Cognitive Science or any of the contributing disciplines.

We offer undergraduate B.A. and B.S. degrees in Cognitive Science, an undergraduate minor, and a graduate certificate. A Cognitive Science major is easy to combine with a second major in the humanities, natural sciences, social sciences, or computer science.

B.A. IN COGNITIVE SCIENCE

The B.A. in Cognitive Science requires a minimum of 14 courses. All majors take COGS 007, an introduction to cognitive science, plus core courses in cognitive psychology, philosophy, artificial intelligence, and cognitive neuroscience, and collaterals in computer science. They also complete a course in research methods or tools. Students then pursue their individual interests by completing at least five electives from across three tracks. Students are required to complete a two-semester senior capstone project (COGS 301 and COGS 302, or, for Honors, COGS 391 and COGS 392), in which students focus on a topic of their choice spanning at least two cognitive science sub-disciplines. Students can opt out of the capstone project by taking two courses at the 200 level and above from the list of major electives.

Additional coursework in affiliated disciplines is recommended, to be selected in consultation with the major adviser and dependent upon anticipated career path. These courses may fulfill college distribution requirements. Note: A number of major courses have pre-requisites. Students considering this major should check pre-requisites and plan accordingly. A preliminary meeting with the program director may be useful.

Collateral Requirements		**7-8**
CSE 007	Introduction to Programming	
or CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	
One course in research methods and tools from the following: PSYC 201 Research Methods and Data Analysis I; PSYC 202 Research Methods and Data Analysis II; ECO 045 Statistical Methods; SOC 211 Research Methods and Data Analysis; CSE 160 Introduction to Data Science; BIOS 130 Biostatistics		
Introductory Course		**4**
COGS 007	Introduction to Cognitive Science	

Disciplinary Core Courses		**15**
COGS/PSYC 117	Cognitive Psychology	
COGS/CSE 127	Survey of Artificial Intelligence	
or COGS/CSE 327	Artificial Intelligence Theory and Practice	
COGS/PSYC 176	Cognitive Neuroscience	
COGS/PHIL 250	Philosophy of Mind	
or COGS/PHIL 251	Philosophical Foundations of Cognitive Science	
Major Electives		**15-20**
Select a minimum of five electives, with at least one course from each of the three tracks.		
Senior Project: Select One of the Following:		**6-8**
Two 200-level or above Major Electives		
COGS 301 & COGS 302	Senior Project in Cognitive Science: Proposal and Senior Project in Cognitive Science: Execution [1]	
COGS 391 & COGS 392	Honors Thesis in Cognitive Science: Proposal and Honors Thesis in Cognitive Science: Project Execution and Thesis [1]	
Total Credits		**47-55**

1

Credits may be split between two advisors but must total 3 per semester.

B.S. IN COGNITIVE SCIENCE

The B.S.in Cognitive Science entails additional courses beyond those in the B.A. to provide both additional breadth and depth. It requires a minimum of 20 courses. All majors take COGS 007, an introduction to cognitive science, plus core courses in cognitive psychology, philosophy, artificial intelligence, and cognitive neuroscience, and collaterals in computer science, math, and social science. They also complete two courses in research methods or tools and at least one semester of supervised research. Students then pursue their individual interests by choosing a concentration area from among three tracks and completing at least six electives with a minimum of four in the concentration area. Students are required to complete a two-semester senior capstone project (COGS 301 and COGS 302, or, for Honors, COGS 391 and COGS 392), in which students focus on a topic of their choice spanning at least two cognitive science sub-disciplines. Students can opt out of the capstone project by taking two courses at the 200 level and above from the list of major electives.

Additional coursework in affiliated disciplines is recommended, to be selected in consultation with the major adviser and dependent upon anticipated career path. These courses may fulfill college distribution requirements. Note: A number of major courses have pre-requisites. Students considering this major should check pre-requisites and plan accordingly. A preliminary meeting with the program director may be useful.

Collateral Requirements [1]		
MATH 021	Calculus I	
or MATH 051	Survey of Calculus I	
or MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	
CSE 007	Introduction to Programming	
or CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	
CSE 140	Foundations of Discrete Structures and Algorithms [6]	
or CSE 160	Introduction to Data Science	
PSYC 001	Introduction to Psychology	
or ECO 001	Principles of Economics	
or ANTH 011	Cultural Diversity and Human Nature	
Two courses in research methods and tools.		**6-8**
For Artificial Intelligence and Formal Models Concentration:		
CSE 140 & MATH 231	Foundations of Discrete Structures and Algorithms and Probability and Statistics	
or ECO 045	Statistical Methods	
For all other concentrations:		
PSYC 201 & PSYC 202	Research Methods and Data Analysis I and Research Methods and Data Analysis II	
Introductory Course		**4**
COGS 007	Introduction to Cognitive Science	
Disciplinary Core Course		**16**
COGS/PSYC 117	Cognitive Psychology	
COGS/CSE 127	Survey of Artificial Intelligence [7]	
or COGS/CSE 327	Artificial Intelligence Theory and Practice	
COGS/PSYC 176	Cognitive Neuroscience	
COGS/PHIL 250	Philosophy of Mind	
or COGS/PHIL 251	Philosophical Foundations of Cognitive Science	
COGS 183	Cognitive Psychology Recitation	
or COGS 184	Cognitive Neuroscience Recitation	
Concentrations		**18-24**
Choose six electives from the concentration lists, at least four of them from within the same concentration. The lists are the same for the B.A. and the B.S. Requirements specific to each concentration for the B.S. are as follows:		
Artificial Intelligence and Formal Models		
CSE 017	Programming and Data Structures	
Cognition, Culture, and Meaning		
COGS 140	Introduction to Linguistics	
Cognitive Neuroscience		
BIOS 044	Introduction to Integrative and Comparative Biology [2]	
Research Experience [3]		**2-4**
COGS 161	Supervised Research [4]	
Senior Project: Select one of the following:		**6-8**
Two 200-level or above Major Electives		
COGS 301 & COGS 302	Senior Project in Cognitive Science: Proposal and Senior Project in Cognitive Science: Execution [5]	
COGS 391 & COGS 392	Honors Thesis in Cognitive Science: Proposal and Honors Thesis in Cognitive Science: Project Execution and Thesis [5]	
Total Credits		**52-64**

1

Collateral courses may count toward CAS distribution requirements where applicable.

2

BIOS 044 pre-reqs: any CHM course that fulfills the pre-requisite for BIOS 041, plus BIOS 041 Introduction to Cellular and Molecular Biology and BIOS 042 Introduction to Cellular and Molecular Biology Laboratory. These are not part of the major but can count toward CAS Natural Science distribution.

3

Students are encouraged to take the required research credits beginning in the second year or even earlier. At least two semesters of relevant research experience (minimum 4 credits) are required for B.S. students prior to enrolling in COGS 391 Honors Thesis in Cognitive Science: Proposal and COGS 392 Honors Thesis in Cognitive Science: Project Execution and Thesis for their senior project.

4

May be repeated for credit.

5

Credits may be split between two advisers but must total 3 per semester (301,302) or 4 per semester (391, 392).

6

Not available in the Artificial Intelligence concentration.

7

This option is not available in the Artificial Intelligence concentration.

MAJOR ELECTIVES

Artificial Intelligence and Formal Models	
CSE 017	Programming and Data Structures
CSE 042	Game Design
CSE 140	Foundations of Discrete Structures and Algorithms
CSE 262	Programming Languages
CSE 318	Introduction to the Theory of Computation
CSE 326	Fundamentals of Machine Learning
CSE 331	User Interface Systems and Techniques
CSE 335	Topics on Intelligent Decision Support Systems
CSE 337	Reinforcement Learning
CSE 347	Data Mining
CSE 348	AI Game Programming
CSE 360	Introduction to Mobile Robotics
CSE 428	Semantic Web Topics
CSE 431	Intelligent Agents
PHIL/MATH 014	Symbolic Logic
PHIL/MATH 114	Metalogic
PHIL 265	Philosophy of Mathematics
Cognition, Culture, and Meaning	
COGS/ANTH/MLL 140	Introduction to Linguistics
CSE 252	Computers, the Internet, and Society
EDUC 391	Educational Linguistics
JOUR 135	Human Communication
PHIL 128	Philosophy Of Science
PHIL 135	Modern Philosophy
PHIL 139	Contemporary Philosophy
PHIL 220	Epistemology
PHIL 228	Philosophy of Specific Sciences
PHIL 260	Philosophy of Language
PSYC 307	Higher Order Cognition
PSYC 313	Person Perception
PSYC 314	Social Cognition
PSYC/HMS 344	Health Care Reasoning and Decision Making
PSYC 351	Children's Thinking
PSYC/EVST 357	Psychology of Environmental Issues
PSYC 362	Cognition in Practice & Policy
PSYC 384	Self and Identity
SOC 118	Sociology of Culture
SOC 226	Computational Text Analysis
Cognitive Neuroscience	
ANTH 012	Intro to Archaeology and Human Origins
ANTH 145	Human Evolution
BIOS 044	Introduction to Integrative and Comparative Biology
BIOS 276	Central Nervous System and Behavior
BIOS 277	Experimental Neuroscience Laboratory
BIOS 332	Behavioral Neuroanatomy
BIOS 365	Neurobiology of Sensory Systems
BIOS 366	Diseases of the Nervous System
BIOS 382	Endocrinology
BIOS 385	Synapses, Plasticity and Learning
BIOS 386	Genes and the Brain
PSYC 012	Introduction to Human Neuroscience
PSYC 347	Topics in Memory
PSYC 355	Seminar in Cognitive Neuroscience
PSYC 377	Attention and Attentional Failures
PSYC 433	Cognitive Neuroscience Techniques

MAJOR ELECTIVES

Artificial Intelligence and Formal Models	
CSE 017	Programming and Data Structures
CSE 042	Game Design
CSE 140	Foundations of Discrete Structures and Algorithms
CSE 262	Programming Languages
CSE 318	Introduction to the Theory of Computation
CSE 326	Fundamentals of Machine Learning
CSE 331	User Interface Systems and Techniques
CSE 335	Topics on Intelligent Decision Support Systems
CSE 337	Reinforcement Learning
CSE 347	Data Mining
CSE 348	AI Game Programming
CSE 360	Introduction to Mobile Robotics
CSE 428	Semantic Web Topics
CSE 431	Intelligent Agents
PHIL/MATH 014	Symbolic Logic
PHIL/MATH 114	Metalogic
PHIL/MATH 214	Topics in Philosophical Logic
PHIL 265	Philosophy of Mathematics
Cognition, Culture, and Meaning	
COGS/ANTH/MLL 140	Introduction to Linguistics
CSE 252	Computers, the Internet, and Society
EDUC 391	Educational Linguistics
JOUR 135	Human Communication
PHIL 128	Philosophy Of Science
PHIL 135	Modern Philosophy
PHIL 139	Contemporary Philosophy
PHIL 220	Epistemology
PHIL 228	Philosophy of Specific Sciences
PHIL 260	Philosophy of Language
PSYC 307	Higher Order Cognition
PSYC 313	Person Perception
PSYC 314	Social Cognition

PSYC/HMS 344	Health Care Reasoning and Decision Making
PSYC 351	Children's Thinking
PSYC/EVST 357	Psychology of Environmental Issues
PSYC 362	Cognition in Practice & Policy
PSYC 384	Self and Identity
SOC 118	Sociology of Culture
SOC 226	Computational Text Analysis
Cognitive Neuroscience	
ANTH 012	Intro to Archaeology and Human Origins
BIOS 044	Introduction to Integrative and Comparative Biology
ANTH 145	Human Evolution
BIOS 276	Central Nervous System and Behavior
BIOS 277	Experimental Neuroscience Laboratory
BIOS 332	Behavioral Neuroanatomy
BIOS 365	Neurobiology of Sensory Systems
BIOS 366	Diseases of the Nervous System
BIOS 382	Endocrinology
BIOS 385	Synapses, Plasticity and Learning
BIOS 386	Genes and the Brain
PSYC 012	Introduction to Human Neuroscience
PSYC 347	Topics in Memory
PSYC 355	Seminar in Cognitive Neuroscience
PSYC 377	Attention and Attentional Failures
PSYC 433	Cognitive Neuroscience Techniques

MINOR IN COGNITIVE SCIENCE

The undergraduate minor in Cognitive Science requires five courses:

COGS 007	Introduction to Cognitive Science	4
Four additional courses selected from among the major's core courses and major electives, with at least two of these being Disciplinary Core Courses		12-16
Total Credits		**16-20**

PROGRAM HONORS

Majors seeking to graduate with honors in cognitive science must have a 3.30 GPA in the major, a 3.30 GPA overall, and complete a high quality senior thesis with enrollment in COGS 391 Honors Thesis in Cognitive Science: Proposal and COGS 392 Honors Thesis in Cognitive Science: Project Execution and Thesis. Theses submitted for honors will be evaluated by a committee of at least three cognitive science faculty.

GRADUATE CERTIFICATE IN COGNITIVE SCIENCE

The graduate certificate provides the opportunity to develop an interdisciplinary perspective on human and machine intelligence. It is available to both enrolled and external students.

Students in Lehigh University graduate degree programs such as computer science, psychology, and instructional technology are encouraged to participate with the approval of an adviser in their major program. Non-degree, post-baccalaureate individuals with sufficient background to complete the coursework are also welcome to undertake the certificate. The certificate may be especially relevant to those working in technology-related fields. Interested individuals should contact the Director of the Cognitive Science Program. External candidates will also need to apply to the College of Arts and Sciences for non-degree graduate status.

The certificate will appear on the student's transcript after submission of a signed completion form by the program director.

The Graduate Certificate requires four courses from the list below. At least two of the courses must be at the 400-level, and the four courses must be spread over at least two departments. For Lehigh degree candidates, at least three of the four courses must be outside the home department. The certificate will entail 12-16 credits.

ELECTIVES

Computer Science	
CSE 327	Artificial Intelligence Theory and Practice
CSE 331	User Interface Systems and Techniques
CSE 335	Topics on Intelligent Decision Support Systems
CSE 348	AI Game Programming
CSE 409	Theory of Computation
CSE 426	Fundamentals of Machine Learning
CSE 428	Semantic Web Topics
CSE 431	Intelligent Agents
CSE 435	Topics on Intelligent Decision Support Systems
CSE 437	Reinforcement Learning and Markov Decision Precesses
CSE 447	Data Mining
CSE 460	Mobile Robotics
Psychology	
PSYC 307	Higher Order Cognition
PSYC 313	Person Perception
PSYC 314	Social Cognition
PSYC/HMS 344	Health Care Reasoning and Decision Making
PSYC 347	Topics in Memory
PSYC 351	Children's Thinking
PSYC 355	Seminar in Cognitive Neuroscience
PSYC 362	Cognition in Practice & Policy
PSYC 377	Attention and Attentional Failures
PSYC 402	Developmental Psychology
PSYC 403	Cognitive Psychology
PSYC 406	Social Cognition
PSYC 433	Cognitive Neuroscience Techniques
PSYC 448	Seminar in Psychology of Language
PSYC 476	Seminar In Cognition
PSYC/COGS 478	Ontological Psychology
PSYC 480	Seminar in Cognitive Development
Philosophy [1]	
PHIL/COGS 250	Philosophy of Mind
PHIL 260	Philosophy of Language
Sociology and Anthropology	
Total Credits	**0**

[1]

Note: These particular 200-level courses may be taken by graduate students.

Courses

COGS 007 Introduction to Cognitive Science 4 Credits
What is a mind? How is the mind related to the brain? Could we make an artificial mind? Issues concerning knowledge representation and intelligence in minds and computers as investigated by psychologists, philosophers, linguists, neuroscientists, and researchers in artificial intelligence.
Attribute/Distribution: SW

COGS 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, NW, SS, SW, W

COGS 098 1-4 Credits
Repeat Status: Course may be repeated.

COGS 117 (PSYC 117) Cognitive Psychology 4 Credits
The architecture and dynamics of the human mind: How we acquire knowledge through perception, represent and activate it in memory, and use it to communicate, make decisions, solve problems, and reason creatively. May not be taken pass/fail.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: SS, SW

COGS 127 (CSE 127) Survey of Artificial Intelligence 3 Credits
An introduction to artificial intelligence (AI) intended for non-majors. AI concepts, systems, and history. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.
Prerequisites: CSE 004 or CSE 007 or CSE 012
Attribute/Distribution: Q

COGS 140 (ANTH 140, MLL 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail.
Attribute/Distribution: SS, SW

COGS 161 Supervised Research 1-3 Credits
Research under the direct supervision of a faculty member in the cognitive science program. Students must arrange the particular project with a faculty member before enrolling. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

COGS 176 (PSYC 176) Cognitive Neuroscience 4 Credits
Perception and cognitive neuroscience as the link between mental processes and their biological bases. Visual and auditory perception; the control of action; neuropsychological syndromes of perception, language, memory, and thought; neural network (connectionist) models of mental processes. May not be taken pass/fail.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: NS, NW

COGS 183 (PSYC 183) Cognitive Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive psychology.
Prerequisites: PSYC 117 or COGS 117
Can be taken Concurrently: PSYC 117, COGS 117

COGS 184 (PSYC 184) Cognitive Neuroscience Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive neuroscience.
Prerequisites: PSYC 176 or COGS 176
Can be taken Concurrently: PSYC 176, COGS 176

COGS 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, NW, SS, SW, W

COGS 250 (PHIL 250) Philosophy of Mind 4 Credits
An exploration of the mind-body problem. Are the body and mind distinct substances (dualism); or is there only body (materialism); or only mind (idealism)? Other views to be considered include behaviorism (the view that behavior can be explained without recourse to mental states), and the view that the mind is a complex computer. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: HE, HU

COGS 251 (PHIL 251) Philosophical Foundations of Cognitive Science 4 Credits
Cognitive Science is the study of aspects of natural and artificial minds: perception, cognition, reasoning, action, and language. Several fields intersect here: artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience. Central issues include: the nature of representation, the boundaries of cognitive science, and consciousness. We will survey the foundational philosophical aspects of these issues within Cognitive Science. Student must have completed at least one Philosophy course at the 100-level, or major in Cognitive Science.
Attribute/Distribution: HE, HU

COGS 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

COGS 300 Apprentice Teaching 1-4 Credits

COGS 301 Senior Project in Cognitive Science: Proposal 1-3 Credits
For students not intending to apply for program Honors. Background reading and preparation of a short written proposal are conducted in the first semester in consultation with a faculty adviser. Students must enroll for a total of three credits which may be split between the sections of a primary and secondary adviser. Consent of program director and project adviser required.
Attribute/Distribution: CC, W

COGS 302 Senior Project in Cognitive Science: Execution 1-3 Credits
For students not intending to apply for program Honors. Execution of the project is conducted in the second semester in consultation with a faculty adviser. A presentation will be given at the end of the semester. Students must enroll for a total of three credits which may be split between the sections of a primary and secondary adviser. Consent of program director and project adviser required.
Repeat Status: Course may be repeated.
Prerequisites: COGS 301
Attribute/Distribution: CC, W

COGS 327 (CSE 327) Artificial Intelligence Theory and Practice 3 Credits
Detailed analysis of a broad range of artificial intelligence (AI) algorithms and systems. Problem solving, knowledge representation, reasoning, planning, uncertainty and machine learning. Applications of AI to areas such as natural language processing, vision, and robotics. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.
Prerequisites: CSE 017 and CSE 140
Attribute/Distribution: Q

COGS 361 Independent Research 2-4 Credits
Independent research in cognitive science with a faculty advisor. Students must arrange the particular project with a faculty advisor before enrolling. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

COGS 391 Honors Thesis in Cognitive Science: Proposal 1-4 Credits
For students with 3.3 or higher major and overall GPA by the spring of the junior year, who want to undertake a project with the potential for program Honors. Literature review and preparation of a written proposal are conducted in the first semester in consultation with a faculty adviser. An oral presentation will be given at end of the semester. Students must enroll for four credits which may be split between co-advisers. Consent of program director and project adviser required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

COGS 392 Honors Thesis in Cognitive Science: Project Execution and Thesis 1-4 Credits
For students with 3.3 or higher major and overall GPA by the spring of the junior year. Project execution and preparation of the written report is conducted in the second semester. An oral presentation will be given at the end of the semester. Theses will be evaluated for Honors by three cognitive science faculty. Students must enroll for a total of four credits which may be split between co-advisers. Consent of program director and project adviser required.
Repeat Status: Course may be repeated.
Prerequisites: COGS 391
Attribute/Distribution: CC, W

COGS 394 Special Topics in Cognitive Science 3-4 Credits
Topics vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

COGS 405 Individual Study in Cognitive Science 1-6 Credits
Study of a topic not covered in regular course offerings. By arrangement with a consulting faculty member. Consent of program director required.
Repeat Status: Course may be repeated.

COGS 423 (PSYC 423) Foundations of Cognitive Science 3 Credits
Survey of fundamental theory and methodologies from artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience, as well as salient research problems such as knowledge acquisition and representation, natural language processing, skill acquisition, perception and action, and the philosophical question of intentionality.

COGS 478 (PSYC 478) Ontological Psychology 3 Credits
Principles and constraints for modeling psychological phenomena. Representation; perception; memory; knowing; learning; emotions; consciousness; language; rationality.

Earth and Environmental Sciences

The Department of Earth and Environmental Sciences (EES) is Lehigh's home for teaching and research in the areas of ecology, environmental science, and geological sciences. Matters of environmental quality and natural resources will increasingly impact people and society in the years to come, and the EES department offers a range of undergraduate and graduate programs that provide students with an understanding of Earth's biosphere, atmosphere, lithosphere, and hydrosphere, with an emphasis on how these components function as an integrated Earth system. Training in Earth and Environmental Sciences can lead to technical and scientific careers in research, environmental consulting, conservation ecology, government agencies, and the energy sector. It can also serve as an excellent liberal arts degree that provides context, depth, and preparation for careers in law, policy, journalism, economics, and health and medicine.

Faculty in the EES department have a wide range of interests and strong reputations in the fields of geology, ecology, and environmental sciences. In instruction at all levels, the department emphasizes field experiences, laboratory techniques, and experiential learning, as well as the development of quantitative and communication skills. The EES department is committed to building diversity and inclusion at Lehigh and in the Earth and Environmental Sciences. As such, we maintain a welcoming, respectful, relaxed, and personal atmosphere where students interact with faculty in many ways, including seminars, special symposia on topics of the students' choice, field research, and departmental field trips.

EES is a core department in the Environmental Initiative Program (EI), which offers students access to interdisciplinary training in Environmental Science, Engineering, and Policy.

At the undergraduate level, students may choose from a B.A. or a B.S. degree in Earth and Environmental Sciences. The flexible B.A. program provides students an opportunity to acquire breadth, design a specialized program, or find room for a double major. A popular choice is a double major in Earth and Environmental Sciences and in Environmental Studies, a major offered through the Environmental Initiative (http://www.ei.lehigh.edu). The B.A. is well suited to students with career aspirations in areas such as engineering, environmental law, journalism, economics, government, and health and medicine. The B.S. degree, while still offering considerable flexibility, provides the more in-depth technical training required for graduate school and scientific careers, and is well suited for students seeking science graduate degrees or employment as professionals in the earth and environmental sciences.

An accessible minor program is available for students wishing to add Earth and Environmental Science insight into any number of other technical or non-technical degree programs, helping students distinguish themselves as they prepare to enter today's fast-evolving job markets and graduate programs.

For students with strong interests in areas such as hydrology, water and soil remediation, hazards and associated geotechnical strategies, EES, in conjunction with the Department of Civil and Environmental Engineering (CEE), offers a five-year program leading to dual B.S. degrees in EES and CEE (students having these interests may also want to see the description of the B.S. in Environmental Engineering in the catalog entry for the Department of Civil and Environmental Engineering).

EES offers graduate training leading to either M.S. or Ph.D. in Earth and Environmental Sciences. The EES graduate program is marked by close faculty-student collaboration. Graduate students can take advantage of strong externally funded faculty research programs and the extensive analytical and computing facilities available in the department; these facilities and specific EES research programs are described in some detail on the EES departmental web page at www.ees.lehigh.edu (http://www.ees.lehigh.edu).

FIELD WORK AND EXPERIENTIAL LEARNING

Field experiences are a hallmark of the EES undergraduate program. The goal of these experiences is to place students into learning environments that are distinct from the classroom or lab, where all the complexities and subtleties of the field can be appreciated in their natural setting. The Department runs a nationally recognized ~5 week long (6 credit) summer field camp in the Rocky Mountains, which offers immersive field training in geology, geomorphology, and field methods including computer-based mapping. The Department has long offered opportunities for field research and courses in Costa Rica that focus on tropical ecology and natural history. Students can also participate in the department's longstanding research programs in hydrology, geochemistry, ecology, and geomorphology of the Lehigh River watershed. Supervised internships allow students at all levels to become engaged in projects involving cross-disciplinary research, assessment, and consulting work. Undergraduate students can also become involved in forefront research programs. In recent years, students have played a role in research in the Himalaya, Alaska, California, Idaho, Argentina, Mongolia, Italy, and the world's oceans in addition to more nearby sites in the mid-Atlantic states. We strongly encourage all EES majors to take advantage of the special field programs and opportunities made available by the department. Most EES courses also include field experiences in the form of one-day or weekend-long field trips, and several courses include weekly or bi-weekly field trips.

PROGRAMS IN EARTH AND ENVIRONMENTAL SCIENCES

The descriptions of the following programs in the Department of Earth and Environmental Sciences are organized as follows:

- Minor in Earth and Environmental Sciences
- Bachelor of Arts Degree in Earth and Environmental Sciences
- Bachelor of Sciences Degree in Earth and Environmental Sciences
- Department Honors in Earth and Environmental Sciences
- Civil and Environmental Engineering and Earth and Environmental Sciences
- Graduate Studies

REQUIREMENTS FOR A MINOR IN EARTH AND ENVIRONMENTAL SCIENCES

A minor is designed for students wishing to explore an area of Earth or Environmental Sciences in conjunction with a major program in another field for personal development or career enhancement.

Select one of		4
EES 080	Introduction to the Earth System [1]	
EES 022 & ONE ADDITIONAL EES COURSE	Exploring Earth: A Natural Science Laboratory and Course ONE ADDITIONAL EES COURSE Not Found	
EES Courses		3
EES Courses at 100 level or above		8
Total Credits		**15**

1

Students are recommended to take EES080 to satisfy upper division prerequisites. Careful planning is required if a student selects EES022 + a course instead.

Natural science (NS) designated EES College seminars (EES 090) may be used to meet minor requirements.

DEGREE REQUIREMENTS FOR A BACHELOR OF ARTS DEGREE IN EARTH AND ENVIRONMENTAL SCIENCES

The B.A. degree is designed with flexibility in mind and is recommended for students interested in a sound liberal arts degree that will permit them to bring a scientific perspective to a wide variety of careers. The degree also permits students to take a double major, or design a specialized program tailored to specific topics in the earth and environmental sciences. Students who choose the B.A. but are interested in attending graduate school should talk to their faculty advisor and consult the B.S. program descriptions to see the type of requirements that may be required for graduate admission.

Core Sequence in EES Major		**9**
EES 080	Introduction to the Earth System	
EES 200	Earth History [1]	
EES 380	The Practice of Science	
Additional Math or Collateral Science [2]		**4**
Choose one course from MATH 009 or higher, BSTA 001, BSTA 002, CHM 030, PHY 010 or PHY 011, CSE 007 or CSE 003 and CSE 004		4
Major Electives		**24**
Select six courses from EES or cross-listed offerings at the 100 level or above. [3, 4]		
Free Electives		
Courses chosen from anywhere in the University's curriculum, sufficient to bring the total to a minimum of 120 credits.		

1

Satisfies a Writing Encounter

2

Students interested in scientific careers or pursuing graduate education in the sciences are recommended to take at least two additional math and collateral science courses chosen in consultation with an advisor.

3

Up to 8 credits of EES internship (EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 293).

4

Four credits of EES 341 may be applied to major electives; all 6 credits for this course apply to the graduation requirement of 120 total credits.

DEGREE REQUIREMENTS FOR BACHELOR OF SCIENCES DEGREE IN EARTH AND ENVIRONMENTAL SCIENCES

Mathematics and Collateral Science Requirements		**22-25**
Select one of the following:		4
MATH 021	Calculus I	
MATH 031	Honors Calculus I	
MATH 051	Survey of Calculus I	
MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	
One additional Mathematics course (MATH 012 and above).		3-4
Select one of the following:		4
CHM 030	Introduction to Chemical Principles	
CHM 040	Honors General Chemistry I	
Select one of the following:		5
PHY 010 & PHY 012	General Physics I and Introductory Physics Laboratory I	
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	
Complete 6-8 credits (at least two additional courses) in Astronomy (ASTR 105 or above), Biology (BIOS 041 or above), Chemistry (CHM 031 or above), Mathematics (MATH 012 or above), Computer Science and Engineering (CSE 003 or above), or Physics (PHY 013 or above).		6-8
Core Sequence in EES Major		**21**
EES 080	Introduction to the Earth System	
EES 115	Surficial Processes	
EES 131	Introduction to Rocks and Minerals	
EES 152	Ecology	
EES 200	Earth History [1]	
EES 380	The Practice of Science	
Major Electives		**28**
Select three courses from EES or cross-listed offerings at the 100 level or above. [2, 3]		12
Select four courses from EES or cross-listed offerings at the 300 level or above. [2, 3]		16
Free Electives		
Courses chosen from anywhere in the University's curriculum, sufficient to bring the total to a minimum of 120 credits.		
Field Requirement [4]		
Select one of the following:		
Internships or work experience, approved by your advisor: the experience must include substantial work in the field involving research and/or technical work.		
EES 341	Field Camp in Earth and Environmental Sciences [2]	
Complete 5 of the following 7 courses		
EES 115	Surficial Processes	
EES 152	Ecology	
EES 201	Seismology: The Earth and Environment	
EES 250	Forest Ecology	
EES 223	Structural Geology and Tectonics	
EES 316	Hydrogeology	
EES 386	Wetland Ecology	

1

Satisfies a Writing Encounter

2

Four credits of EES 341 may be applied to major electives; all 6 credits for this course apply to the graduation requirement of 120 total credits.

3

Up to 8 credits of EES internship (EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 293).

4

Courses used to satisfy the field requirement may be used to satisfy EES degree requirements.

DEPARTMENT HONORS IN EARTH AND ENVIRONMENTAL SCIENCES

Students in either the B.A. or B.S. degree programs may undertake a program that leads to graduation with department honors. To participate, the student must (1) have a minimum major GPA of 3.4 and an overall cumulative GPA of 3.0 expected at graduation, (2) complete at least four credits of EES 393 (Supervised Research in Earth and Environmental Sciences), and (3) prepare a written honors thesis on the EES 393 research project. To graduate with honors students should (1) file a written request with the EES undergraduate instruction coordinator no later than the beginning of the senior year (preferably during the junior year), (2) constitute an advisory committee of two EES faculty plus the student's research supervisor to guide the research, (3) prepare a research proposal for committee's approval, and (4) give an oral presentation of research results and conclusions at a department seminar on or before the last day of classes in the second semester of the senior year. The committee should approve the research proposal and the honors thesis by signing the required form and cover sheet, which will be filed with the Department.

CIVIL AND ENVIRONMENTAL ENGINEERING AND EARTH AND ENVIRONMENTAL SCIENCES

This program is designed for students interested in combining programs in two departments: Civil & Environmental Engineering and Earth & Environmental Sciences, leading to two bachelor of science degrees, a civil and environmental engineering B.S. degree and a B.S. degree in earth and environmental sciences. Both degrees would be awarded at the end of the fifth year. This program is one of the dual degree programs mentioned in the Five-Year Programs section. The student will have a primary advisor in the P.C. Rossin College of Engineering and Applied Sciences and a secondary advisor in the College of Arts and Sciences. The program provides alternatives for students who may decide not to complete the dual-degree program. Students who make this decision prior to the beginning of the fourth year may qualify at the end of that year for the bachelor of science in civil or environmental engineering, as well as a minor in earth and environmental sciences. Also, if a student decides after two years to pursue only a B.S. degree in the EES department, it is possible to complete the requirements in four years. If the decision to work toward this degree is made during the fourth year, at least one additional semester is required to qualify for either B.S. degree. Interested students should consult with the respective departmental advisors to create a schedule of courses to resolve conflicts or if a specified course is not offered that semester. Required courses and major electives for the EES B.S. degree are listed in the catalog entry for EES. Crosslisted EES/CEE courses used to satisfy Civil Engineering Approved Electives can reduce the individual semester and total program credits when chosen to satisfy EES program requirements. The dual degree, and a suggested schedule of courses, is described more fully elsewhere in the catalog (p. 432). Additional useful information can be found on the web sites (www.lehigh.edu/~incee/ (http://www.lehigh.edu/~incee/) and www.ees.lehigh.edu (http://www.ees.lehigh.edu)).

GRADUATE STUDIES

The Department of Earth & Environmental Sciences offers graduate programs leading to the M.S. and Ph.D. in Earth and Environmental Sciences. These degrees emphasize what we feel is an important and growing trend in ecology, environmental science, and geology, namely the blending of expertise and perspectives from many disciplines. Research is an integral component of all EES graduate programs and leads to an M.S. thesis or Ph.D. dissertation prepared under a research supervisory committee and chaired by a departmental faculty research advisor. An advising commitment by one or more faculty members is required for graduate admission.

The University has outlined the general academic requirements for M.S. and Ph.D. students in its Graduate Student Handbook, and EES has additional Departmental requirements that must also be fulfilled. It is the student's responsibility to insure that all graduation requirements are met. All graduate students work with an advisor who chairs the student's research supervisory committee. Graduate students make annual presentations of their research to the Department. All graduate students are required to take one of the Department's graduate core courses (EES 411, EES 426) and five additional courses (15 credits) at the 400-level. M.S. students complete 30 credits of coursework and thesis research and orally defend a written thesis that encompasses the findings and conclusions of their research. Candidates for the Ph.D. must first pass the qualification evaluation in the first year, then defend their dissertation proposal in the General Exam, and finally, orally defend a dissertation. For more details beyond this brief summary, please see the graduate handbook online at: http://www.ees.lehigh.edu/content/overview-ees-graduate-program (http://www.ees.lehigh.edu/content/overview-ees-graduate-program/)

Research Facilities

Our Department is well equipped for a broad range of field and laboratory investigations in the Environmental, Ecological, and Geological Sciences. Our laboratories and equipment include:

- Petrographic microscopy facilities, rock-crusher, ball mill, rock saws, and cathodoluminescence and camera lucida digitizing capabilities;
- Laboratory for Ar-Ar, U-Th/He, and fission-track geochronology including dual UV and CO2 lasers, VG 3600 noble-gas mass spectrometer, Balzers quadrupole mass spectrometer, dedicated He and Ar extraction lines with low-blank furnaces, all under full LabVIEW automation;
- A stable isotope geochemistry laboratory equipped with a Finnigan MAT model 252 mass spectrometer (with dual-inlet and carrier gas capabilities), on-line peripherals, and off-line vacuum extraction lines, for O, H, C, and N isotope analyses of silicate minerals and rocks, carbonates, fluid inclusions, and organic matter;
- Equipment for sampling groundwater wells as well as automated samplers for surficial water systems;
- A microbial ecology laboratory (fluorescence and phase contrast microscopy, bioreactors, UV phototron, walk-in controlled environment chambers);
- Field instruments to characterize solar radiation (UV bands, PAR, broadband, and high resolution spectral irradiance with automated shadowband options for diffuse and direct spectral irradiance), water quality & optical properties (Biospherical PUV profilers, YSI datasondes, SCUFA CDOM fluorometers), weather parameters, and hydrology (precise water level, precipitation, wind, humidity, atmospheric pressure, water temperature thermistor chains) plus automated ISCO rain-triggered samplers for applications in aquatic and terrestrial ecosystem studies;
- Aquatic ecology laboratory instruments to characterize water quality and optical properties (pH, specific conductance, dissolved oxygen, UV-VIS spectrophotometers, scanning fluorometer, Turner CDOM/Chlorophyll fluorometer, N & P nutrient analyzer, automated Shimadzu TOC/TN analyzer, CHN analyzer, scintillation counter, photobleaching laboratory, low-carbon water purification system);
- An aqueous geochemistry laboratory with a ThermoElectron X-Series inductively-coupled plasma mass spectrometer with collision cell, and hydride generation apparatus that can be coupled to an HPLC system for species analysis, a Dionex ion chromatograph for simultaneous analysis of anions and cations, a Mercury analyzer for analysis of gaseous and liquid samples, and a Class 100 clean room for ultra trace sample preparation; additional instruments including a Waters computer-assisted ion chromatograph, an ARL 34000 inductively-coupled plasma atomic emission spectrometer, a Netzsch DTA/TGA instrument,

and a high-pressure core-holder/column reactor for flow-through experiments;
- A sedimentation and soils analysis laboratory including equipment for particle size analysis;
- A paleomagnetism laboratory with a magnetically shielded room, a 2G superconducting magnetometer and built-in af demagnetizer, Molspin spinner magnetometer, a Schonstedt AF demagnetizer modified to apply pARMs, and an ASC thermal demagnetizer, and a KLY-3S Kappabridge magnetic susceptibility system, and an ASC impulse magnetizer;
- A reflection seismology laboratory has equipment including broadband seismometer linked to global networks; computer workstations for seismic processing, Bison DIFP multi-channel seismograph, various seismic energy sources, and ground-penetrating radar;
- Field geophysical equipment includes a Worden Master gravimeter, and a Geometrics portable proton precession magnetometer;
- Geomorphology lab including a Topcon total station, flow gages, LASCI digitizer, complete airphoto analysis facility, and a flume facility in the CEE hydraulics lab. We also maintain several PC and UNIX computer labs devoted to GIS (ArcGIS) and large spatial digital topographic databases;
- Paleoecological laboratories with facilities for the analysis and photo documentation of tree rings, pollen, macrofossils, and other biological and physical parameters of environmental archives, including lake and peatland sediments.
- A sediment core laboratory with facilities for initial core preparation and core storage, including a walk-in cold room, a GeoTek MultiSensor Core Logger, a VirTis AdVantage Freezer Dryer and various corers (Livingstone, Mackereth, Glew Gravity, Russian peat Corers);
- A remote sensing laboratory with image processing software, extensive spatial data collections, as well as equipment for measuring field characteristics of important remotely sensed parameters.

Courses

EES 002 (EVST 002) Introduction to Environmental Science 3 Credits
Focuses on natural and human-induced drivers and consequences of environmental change. Exploring options for mitigating and adapting to environmental change in ecosystems, physical and social systems, the course examines such topics as biogeochemical cycles, population pressure, ecosystem diversity, productivity and food security, energy, water resources, climate change, pollution, ozone, urban issues and sustainability. Stresses interactions using case studies. Intended for any student with an interest in the environment. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 004 The Science of Environmental Issues 1 Credit
Analysis of current environmental issues from a scientific perspective. The focus on the course will be weekly discussions based on assigned readings. May be combined with other EES 3 credit courses for 4 credits.
Attribute/Distribution: NS, NW, Q

EES 014 Lands of the Midnight Sun 3 Credits
Investigations of polar exploration and science, the environment at high latitudes, and cultures of the Arctic, as well as discussion of issues related to understanding interactions among extreme environments, global change, pollution, and indigenous cultures. Lecture, discussion, classroom activities. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 015 Volcanoes and the Ring of Fire 3 Credits
Volcanoes are a tangible, often breathtaking, reminder of the inner workings of our restless planet. In this course, we consider the processes leading to volcanic eruptions, the significance of volcanism for long-term Earth evolution, and the hazards volcanoes create for humans, particularly those living in the circum-Pacific (the Ring of Fire). May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 016 Geology of War 3 Credits
Introduction to Earth and Environmental Sciences through a study of the resource and environmental change causes of human conflict. Earth and Environmental Science basis for permanent and contingent operating factors during war. Instructional format includes lectures, discussions, student projects, and a field trip to Gettysburg National Military Park. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 021 Dynamic Earth 3 Credits
Processes within the Earth and dynamic interactions between the solid earth, the atmosphere, and the oceans. Lectures. May be combined with EES 022 or EES 004.
Attribute/Distribution: CC, NS, NW

EES 022 Exploring Earth: A Natural Science Laboratory Course 1 Credit
Earth is a dynamic planet. Building on the framework of the “Earth Science Literacy Initiative” this laboratory course explores how Earth systems influence our lives, and in turn how our lives impact Earth systems. Topics include deep time, complex systems, continuous change, land use, biodiversity, resources, hazards, climate change, and sustainability. Students gain experience in exploration and discovery, quantitative reasoning, objective evidence based decision making, communication, critical thinking, and creativity.
Attribute/Distribution: NS, NW, Q

EES 023 Weather and Climate: Past, Present, and Future 3 Credits
Introduction to the basic principles of meteorology, as they pertain to past, present, and future climates. Earth’s energy balance; cloud formation and precipitation; winds and atmospheric circulation; regional climatologies; past warm periods and ice ages in Earth’s history; the latest ideas about future climate change and global warming. Students will maintain a weather notebook to enable them to relate theory to observations from real weather data. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 024 Climate Change 3 Credits
Examination and discussion of Earth’s climate history and the multiple interactions among components of the climate system, including ice, water, air, land, and vegetation; review of the causes of climate change at various time scales. Assessment of historical and future climate change and the role of humans in causing climate change, including global warming. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 025 The Environment and Living Systems 3 Credits
The course will provide an introduction to the role of the environment in regulating living systems at a variety of scales and levels of organization. The role of the environment in regulating and shaping populations, communities, and ecosystems will be explored. In addition, the role of the environment will be discussed as it relates to the origin, evolution, and diversity of life on earth. Whenever possible, the role of anthropogenic environmental change will be discussed as it relates to the.
Attribute/Distribution: CC, NS, NW

EES 026 Energy – Origins, Impacts, and Options 3 Credits
Critical assessment of current and predicted energy resources used by humans, including their origins, distribution, environmental impacts, and feasibility. Lectures, discussion, field trips. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 027 Natural Hazards: Impacts and Consequences 3 Credits
Earthquakes, volcanoes, tsunamis, floods, and hurricanes are a natural part of the Earth and our environment. These events have violent consequences for our lives and significant economic implications. This course examines the causes, predictability, and risk mitigation for these events. We will also consider how natural disasters are represented by popular media and whether this helps or hurts public understanding of our dynamic planet and our relationship to it. May be combined with EES 022 or EES 004 for 4.
Attribute/Distribution: CC, NS, NW

EES 028 Conservation and Biodiversity 3 Credits
An introduction to the science of conservation biology. We examine the evolution of biodiversity on earth, spatial patterns of biodiversity, the impact of human activities on biodiversity, and assess strategies for the management and conservation of biodiversity. Students gain the scientific literacy necessary to make informed decisions about topics such as wilderness preservation, species conservation, and land use. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 029 Human Health and the Environment 3 Credits
An introductory course that explores the connections between the environment and human health. Topics related to human health include climate change, energy production, genome-environment interactions, zoonotic disease, and drinking water chemistry. Introduction to the disciplines of geochemistry, ecology, geospatial data analysis, environmental epidemiology, toxicology, risk assessment, and exposure science. Course format includes a combination of lectures on fundamentals and seminar style topical readings. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EES 032 (BIOS 032) Oceanography 3 Credits
An introduction to the structure, composition, and processes of the earth from a marine perspective. Topics include earth structure, plate tectonics, continental margins, coastal processes, seawater chemistry, ocean circulation, wave dynamics, primary productivity, plankton and plants, marine organisms and communities. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS, NW

EES 033 Life from Stardust 3 Credits
An examination of the history of planet Earth and the development of life. Includes the formation of Earth and the evidence for changing conditions in the inter-connected geosphere, hydrosphere, atmosphere, and biosphere over the past 4.5 billion years, and theories for the origin and early evolution of life. Discuss the tools used for the search for life on other planetary bodies, both in our solar system and around other stars. May be combined with EES022 or EES004 for 4 credits.
Attribute/Distribution: NS, NW

EES 034 Global Change, Microbial Forces 3 Credits
This course investigates how microbes that are invisible to the naked eye play highly influential roles in global environmental change. We will explore these phenomena in terrestrial and aquatic systems, from urban to remote regions. We will conclude by examining ways to harness the power of microbes to combat facets of global change.
Attribute/Distribution: CC, NS, NW

EES 072 Topics in Earth and Environmental Science 1-4 Credits
Study of topics in earth and environmental science not covered in other introductory courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, NS, NW, Q, W

EES 080 Introduction to the Earth System 0,4 Credits
Study of the earth system, including the atmosphere, biosphere, geosphere, and hydrosphere and their interactions (e.g., plate tectonics, biogeochemical cycling, climate, anthropogenic impacts). The course is designed to prepare students for a major in EES and includes a lab that develops important skills including data analysis, modeling, use of maps and geospatial data, and field work. Lectures and lab. Open to declared EES majors and minors. Also open to intended majors and others by departmental permission.
Attribute/Distribution: CC, NS, Q, W

EES 093 Freshman Supervised Internship in Earth and Environmental Sciences 1-2 Credits
Experiential learning opportunities supervised by EES faculty, including fieldwork, data collection or analysis, literature review, and information management. A maximum of two credits is allowed. Consent of supervising faculty required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, Q, W

EES 102 Environmental Science and Sustainability 0,4 Credits
An examination of how the Earth and environment sustain human health and well-being, how our actions support and conserve or disrupt and deplete natural systems and resources, and how environmental impacts are distributed globally and socioeconomically. Focus on scientific inquiry, quantitative reasoning, evidence based decision making, cultivating curiosity, and the challenges and opportunities of living sustainably. Active learning and case studies. Required for registration: completion of at least 1 credit of any EES course.
Attribute/Distribution: CC, NS, NW, Q

EES 115 Surficial Processes 0,4 Credits
An introduction to process geomorphology and sedimentology that emphasizes the dynamic interactions of climate, tectonics, and watershed hydrology on the erosional, transportational, depositional, and biological processes that shape landscapes. Includes a field and computer-intensive lab.
Prerequisites: EES 080
Can be taken Concurrently: EES 080
Attribute/Distribution: NS, Q, W

EES 131 Introduction to Rocks and Minerals 0,4 Credits
Hand-specimen identification of the major mineral groups and rock types. Atomic structure of minerals; relationship of mineral structure to chemical and physical properties. Placement of igneous, sedimentary, and metamorphic rocks into a plate tectonics context. Introduction to optical mineralogy and x-ray diffraction techniques. Lectures, laboratories, field trips.
Prerequisites: EES 080 or (EES 021 and EES 022)
Can be taken Concurrently: EES 080
Attribute/Distribution: CC, NS, NW

EES 152 Ecology 0,4 Credits
The study of relationships among organisms and their physical environment. Ecology of individual organisms, populations, communities, ecosystems, landscapes, and the biosphere. Topics include organism adaptations and natural selection, life histories, population growth and dynamics, species interactions, energy flow, nutrient cycling, and ecological impacts of human activities. Field-based laboratories focus on the quantitative study of biological populations and communities. Lectures, field-based laboratories, and applied activities.
Prerequisites: EES 025 or EES 028 or EES 080
Can be taken Concurrently: EES 025, EES 028, EES 080
Attribute/Distribution: CC, NS, NW, Q

EES 172 Topics in Earth & Environmental Science 1-4 Credits
Study of topics in earth and environmental science not covered in other 100-level courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, NS, NW, Q, W

EES 200 Earth History 0,4 Credits
Review of the coevolution of Earth, life, climate, and the environment, and introduction to the records used to constrain this history. The course addresses environmental changes at both geologic and human time spans. Includes laboratory exercises and field trips.
Prerequisites: EES 080
Attribute/Distribution: NS, W

EES 201 Seismology: The Earth and Environment 0,4 Credits
An examination of how earthquakes and active source seismology are used to understand the Earth beneath our feet. Fundamentals of seismic wave propagation in the Earth. Study of earthquakes, and reflection and refraction techniques at a variety of scales: near-surface, crustal, lithospheric, and whole Earth. Practical applications to both earth and environmental science, experiment design, data collection, processing, analysis and interpretation. Field and laboratory projects.
Prerequisites: EES 080 and EES 115 and EES 131
Can be taken Concurrently: EES 115
Attribute/Distribution: NS, Q, W

EES 223 Structural Geology and Tectonics 0,4 Credits
Material behavior of rocks and the architecture of the Earth's crust. Plate tectonic processes and plate margin deformation. Introduction to geologic maps and field techniques. Lectures, laboratories, and one or two weekend fieldtrips.
Prerequisites: EES 115 or EES 131
Can be taken Concurrently: EES 131
Attribute/Distribution: WRIT

EES 250 Forest Ecology 0,4 Credits
The study of forested ecosystems around the globe. Topics include abiotic and biotic drivers of forest diversity, forest dynamics and structure, and human impacts and management. Laboratory/field activities foster practical skills such as plant identification, experimental design, data collection, data analysis in Excel and R, data visualization, oral communication, and scientific writing. Lectures, field-based laboratories, and applied activities.
Prerequisites: EES 115 or EES 152
Attribute/Distribution: Q, W

EES 293 Supervised Internship in Earth and Environmental Sciences 1-4 Credits
Experiential learning opportunities supervised by EES faculty, including data collection or analysis, literature review, and/or information management most likely as part of a longterm, continued project. The student should submit a work plan that describes activities involved and credits requested. A maximum of four credits of EES 293 and no more than eight credits combined from EES 093, EES 293 and 393 may be applied to EES B.A. and B.S. degrees (additional credits apply to free electives). Consent of supervising.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, NS, Q, W

EES 300 Apprentice Teaching 3 Credits

EES 306 Geologic Records of Environmental Change 3,4 Credits
This course provides an overview of high-resolution geologic records of environmental and global change, how they are analyzed, and how they can be used in a variety of disciplines. Time series analysis, age control, completeness of sequences, and correlation of records will be covered. A class project will use acquisition and analysis of environmental magnetic data to demonstrate how records of global and environmental change are constructed.
Prerequisites: EES 080 and EES 115
Attribute/Distribution: NS

EES 316 (CEE 316) Hydrogeology 0-4 Credits
Water plays a critical role in the physical, chemical, and biological processes that occur at the Earth's surface. This course is an introduction to surface and groundwater hydrology in natural systems, providing fundamental concepts and a process-level understanding using the hydrologic cycle as a framework. Geochemistry will be integrated to address natural variations and the human impact on the environment. Topics covered include: watershed hydrology, regional and local groundwater flow, water chemistry, and management of water resources. Lectures and laboratory.
Prerequisites: (EES 080 and EES 115 or EES 131 or EES 152) or (CEE 170)
Can be taken Concurrently: EES 115, EES 131, EES 152
Attribute/Distribution: NS, Q, W

EES 318 Geographic Analysis in EES 0-4 Credits
Techniques for acquisition, manipulation and integration of data in Geographic Information System (GIS) environment, with emphasis on statistical and spatial analysis. Traditional and digital maps, spatial data collection and integration, geodesy concepts and time series analysis will be applied to case studies and projects relevant to Earth sciences, environmental sciences, and other disciplines according to the diversity of the audience. Different OS platforms and software will be used throughout the course. Includes lectures and laboratory exercises.
Prerequisites: (EES 080 and (EES 115 or EES 152),) or ES 319
Attribute/Distribution: CC, NS, Q

EES 320 (CEE 320) Engineering Hydrology 3 Credits
Rainfall-runoff analysis, overland flow, hydrograph theories, modeling. Frequency analysis of extreme events. Flood routing. Design storms. Floodplain hydraulics, floodplain delineation.
Prerequisites: (CEE 222)
Attribute/Distribution: NS

EES 323 (CEE 323) Environmental Groundwater Hydrology 3 Credits
The study of subsurface water, its environment, distribution, and movement. Included are flow patterns, well hydraulics, and an introduction to the movement of contaminants. Design problems are included to simulate flow with analytical and numerical models, and contaminant migration using analytical models.
Prerequisites: CEE 122 or CEE 316 or EES 316 or ME 231 or CHE 044

EES 325 Remote Sensing of Terrestrial and Aquatic Environments 0-4 Credits
Techniques of observing the Earth from air- and space-borne instruments, including issues of geometry and scale associated with making measurements, electromagnetic properties of Earth surface materials, the range of instruments used to observe the Earth, image interpretation, and applications of satellite remote sensing to geological, ecological, and environmental questions. Lecture and lab.
Prerequisites: (EES 080 and (EES 115 or EES 152 or EES 131),) or ES 319
Attribute/Distribution: CC, NS, Q

EES 327 (CEE 327) Surface Water Quality Modeling 3 Credits
Fundamentals of modeling water quality parameters in receiving water bodies, including rivers, lakes, and estuaries. Modeling of dissolved oxygen, nutrients, temperature, and toxic substances. Emphasis on water quality control decisions as well as mechanics and model building.
Prerequisites: (CEE 122 or ME 231 or CHE 044) and CEE 222

EES 334 Geosphere Structure and Evolution 3,4 Credits
Synthesis of the state of knowledge of Earth structure and long-term evolution, with emphasis on the crust and mantle, and integrating petrologic, geophysical, and geochemical perspectives. Mass and energy transfer through time among the crust, mantle, hydrosphere, biosphere, and atmosphere. Petrographic study of selected rock suites, and introduction to geophysical observations of the deep structure of the solid Earth. Lectures, discussion, laboratories, field trip.
Prerequisites: EES 080 and EES 115 and EES 131
Attribute/Distribution: NS, Q

EES 341 Field Camp in Earth and Environmental Sciences 6 Credits
Integrated, capstone field experience for Earth and Environmental scientists using the diverse natural settings of the Rocky Mountains as the classroom. Projects challenge students to synthesize field data in solving real science problems. Projects include but not limited to classic and computer-based geologic mapping, section measuring, structural analysis, stream hydrology, sediment transport. Five weeks in the field; summer session. Students must apply through the Lehigh Field Camp Program, consent of Field Camp director required. Must have declared major in EES.
Prerequisites: EES 131 and EES 115 and EES 223 and EES 316
Attribute/Distribution: CC, NS, Q

EES 343 Climate and Earth System Modeling 4 Credits
Introduction to the basic principles of meteorology and climate necessary to understand Earth system models and future global change. Students will use a range of software to provide hands-on experience with different types of models, ranging from Energy Balance Models (EBMs) to Earth System Models of Intermediate Complexity (EMICs), and Global Climate Models (GCMs) applied to the atmosphere, ocean, land surface, carbon cycling, and ice. Lecture and recitation.
Prerequisites: EES 080
Attribute/Distribution: CC, NS, Q

EES 352 Aquatic Biogeochemistry 3,4 Credits
Study of biogeochemical cycles in aquatic environments, investigating the abiotic and biotic factors that regulate microbial functions. Special emphasis will be on light, heat, carbon, salinity, nutrients (N+P), metals, dissolved gasses and their interplay with primary production and secondary production in various ecosystems. Organic and inorganic forms of microbial metabolism will be covered. Field and experimental methods, as well as data analysis, will be used to underscore critical principles in aquatic biogeochemistry.
Attribute/Distribution: NS, Q, W

EES 357 Paleoecology and Landscape History 3,4 Credits
Principles and methodologies of paleoecology, with emphasis on palynology. Applications of paleo-records in tracing flora, vegetation, climate and landscape history. Long-term ecological interactions and ecosystem responses to past environmental change. Field and laboratory experiences in collecting and characterizing sediments and in processing and interpreting fossil pollen and other proxy data. Students will explore regional vegetation, climate and landscape history by coring and analyzing sediments from lakes and wetlands. requires one or more weekend day-long field trips.
Prerequisites: EES 080 or EES 115 or EES 152 or EES 250
Attribute/Distribution: NS

EES 358 Microbial Ecology 0-4 Credits
The role of microorganisms in the environment. Topics include: Survey of microbial classification, diversity, structure, assembly, and metabolism; study of microbes at population, community, and ecosystem levels of organization; the roles of biotic interactions and abiotic parameters in driving the ecology and evolution of microorganisms; state-of-the-art methods to investigate complex microbial assemblages in terrestrial, marine, and subsurface environments; application of microbes to bioremediation and resource recovery problems.
Prerequisites: EES 152
Attribute/Distribution: CC, NS, W

EES 363 Volcanology 0-4 Credits
Volcanic eruptions can result in devastating effects on both a regional and a global scale. This course will examine physical dynamics that control eruptive processes at active volcanoes. Topics will include the role of volatiles, magma decompression, magma chamber and conduit dynamics, magma rheology, crystallization, fragmentation criteria, and transitions from explosive to effusive behavior. We will examine specifically how geochemical/textural analyses of volcanic rocks and minerals can provide quantifiable information on eruption processes.
Prerequisites: EES 131 and EES 115
Attribute/Distribution: NS, Q

EES 372 Topics in Earth & Environmental Science 0-4 Credits
Study of topics in earth and environmental science not covered in other 300-level courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, NS, Q, W

EES 376 Geochemistry of Natural Waters 3,4 Credits
Introduction to aqueous geochemistry. Applications of thermodynamics, mass balance, systems science, and kinetics to understanding mineral-water interactions in natural aquatic systems on a variety of spatial and temporal scales. Laboratories emphasize analytical and computer methods. Lectures, and seminar/laboratory.
Prerequisites: EES 080 and EES 115
Can be taken Concurrently: EES 080
Attribute/Distribution: CC, NS, Q

EES 379 (CEE 379) Environmental Case Studies 3 Credits
Case studies will be used to explore the impact of politics, economics, society, technology, and ethics on environmental projects and preferences. Environmental issues in both affluent and developing countries. Multidisciplinary student teams investigate site characterization; environmental remediation design; environmental policy; and political, financial, social, and ethical implications of environmental projects.
Prerequisites: EES 022 or CEE 375 or CHE 375

EES 380 The Practice of Science 1 Credit
The knowledge, skills, and discipline of mind developed in the Earth and Environmental Sciences major present students with a number of opportunities and career paths. Students will explore a variety of career paths and further develop professional skills. The seminar explores strategies for applying to graduate school or for a job, professional ethics and responsibility, and the methods and process of effective communication. Must have EES Major and senior standing.
Attribute/Distribution: NS

EES 386 Wetland Ecology 0-4 Credits
Ecology of wetlands and factors controlling wetland structure and function. Responses and feedbacks of wetlands to natural and human-induced environmental variability. Topics include wetland classification and delineation, origin and development of wetlands, biotic adaptations to the wetland environment, wetland hydrology, wetland biogeochemistry and microbial communities, wetland vegetation dynamics, and wetland restoration. Lectures, laboratories, applied activities, and field trips.
Prerequisites: EES 152
Attribute/Distribution: NS

EES 387 Sustainability in Latin America 3,4 Credits
Seminar discussing issues surrounding environmental sustainability in Latin America and the Caribbean from a holistic, interdisciplinary perspective. Introduction to the three legs of sustainability and sustainable development theory, as well as the ecology and evolution of biodiversity in the American tropics. Use of published primary literature and podcasts to explore the particular complexities of Latin American sustainable development, and analysis of case studies in which environmental issues were either championed or de-emphasized. Readings, discussions, and one major project.
Prerequisites: EES 102
Attribute/Distribution: CC, W

EES 393 Supervised Research in Earth and Environmental Sciences 1-4 Credits
Research opportunities supervised by EES faculty to carry out a well-defined project, including exposure to problem definition, selection of research approach, and communication of results. The student should prepare a proposal and, if taking 3 or more credits, should present the results at Undergraduate Research Symposium and write a research thesis. Both proposal and thesis are filed with EES Department. No more than eight credits may be applied to EES B.A. and B.S. degrees (additional credits apply to free electives).
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, Q, W

EES 402 (EVST 402) Scientific Foundations for Environmental Policy Design 3 Credits
This course explores the science behind the environmental issues that bear on policy process at local, national and global scales. The course delves into the science of selected environmental issues that have either arisen from anthropogenic activities, that impact social systems, or that help policy-makers understand the consequence of different policy options. The course consists of readings and discussions of timely topics and one major project.

EES 403 Earth System Modeling 3 Credits
This course will introduce the concepts behind computer modeling, including deterministic vs stochastic, stocks and fluxes, finite differencing, initial and boundary conditions, sensitivity, feedbacks, calibration, validation, and uncertainty. We will apply these ideas to projects of interest to students in the course, and may include any of the components of the earth system. Students will learn both agent-based and systems dynamics modeling using NetLogo, Stella, and Excel, simple programming with C++, and research-oriented models as their independent research projects allow.
Repeat Status: Course may be repeated.

EES 405 Paleo- and Environmental Magnetism 3 Credits
Topics in paleomagnetism and environmental magnetism. Class will design and conduct a research project, read the relevant literature and write a research paper. Consent of instructor required.

EES 407 Seismology 3 Credits
Seminar on advanced topics in seismology, review of classic and current literature. Topics include but are not limited to: wave propagation in ideal media and earth materials, seismic imaging of complex structures, tomography, modeling, and high-resolution seismic imaging. Must have completed an introductory geophysics course.

EES 411 Physical and Chemical Processes at the Earth's Surface 3 Credits
An advanced treatment of physical and chemical processes and their interaction in the critical zone. Quantitative methods, modeling, and process-oriented approaches are presented in a systems context from the meter, to watershed, to continental scale. Topics include weathering and soils, chemical and physical fluxes from watersheds, and global hydrology and erosion.

EES 412 Advanced Fluvial and Tectonic Geomorphology 3 Credits
Lecture, seminar, lab, and field-based investigation of the classic and contemporary geomorphologic literature using the processes and evolution of a watershed and its dynamic interaction with tectonics as a integrative common theme. Topics change according to student interest but typically include active tectonics, fluvial processes, landscape response to climate, and biogeomorphology. Include ArcGIS training, field trips, flume analogue modeling, and class projects with the goal of a published paper.

EES 414 Glacial and Quaternary Geology 3 Credits
Study of the origin, distribution, and movement of present and past glaciers. Special emphasis on glacial land forms and deposits, Quaternary stratigraphy and dating techniques, periglacial phenomena, and Pleistocene environments. Lectures and required field trips. Consent of instructor required.

EES 415 Paleoclimatology 3 Credits
Overview of climate system, including energy budget, feedbacks, atmospheric and ocean circulations, and their interactions. Earth's climate history and mechanisms of past climate variations at various time scales, with emphasis on late Quaternary. Lectures, presentations and discussion of recent literature, especially on approaches to studying climate change and paleo-perspectives on ongoing climate change. Must have graduate standing in EES, or consent of course instructor.
Repeat Status: Course may be repeated.

EES 426 Tectonic Processes 3 Credits
Current models of tectonic processes in intraplate settings and at plate boundaries. Critical evaluations by the class of the geological, geochemical and geophysical data sets which gave rise to these models. Must have graduate standing in EES, or consent of department chairperson.

EES 427 Orogenic Belts 3 Credits
Geometry, kinematics, and mechanics of orogenic belts. will explore current paradigms of depositional, deformational, and metamorphic processes in the Earth's crust. Lectures, seminars, and field trips. Topically variable Consent of instructor required.
Repeat Status: Course may be repeated.

EES 429 Methods and Applications of Geochronology 3 Credits
Examination of isotopic techniques used to measure geologic time, and their applications. Lectures, laboratories, research projects, field trips. Must have graduate standing in EES.
Repeat Status: Course may be repeated.

EES 438 Petrogenetic Processes 3 Credits
Metamorphism, melting, and magmatism in the Earth's crust and mantle. Tectonic evolution, crust-mantle heat and mass transfer, fluid-rock interactions, and rate processes. Varying combinations of lecture and seminar formats. May be repeated for credit when topics differ. May include laboratory and field experience and computational exercises. Consent of instructor required.
Repeat Status: Course may be repeated.

EES 446 Human-Climate Interactions 3 Credits
This course explores climatic impacts of human activity, along with feedbacks between climate change and the land/sea surface, hydrology, productivity, etc., in the context of assessing both the causes and societal consequences of climate change. Such consequences include storm frequency, SSTs, floods/droughts, sea level rise, etc. Emphasis is placed on understanding the processes controlling climate response greenhouse gases, land cover, and land-atmosphere / ocean-atmosphere mass and energy exchanges.

EES 453 Advanced Microbial Ecology 3 Credits
Lectures and seminars will focus on topics of current interest in the microbial ecology of pelagic (freshwater and marine), sediment, and/or soil environments. Emphasis will be placed on the role of microbes in ecosystems level processes such as energy transformations and elemental cycling. May include laboratory and field exercises. Must have graduate standing or consent of course instructor.

EES 457 Advanced Remote Sensing of the Environment 3 Credits
Seminars and hands-on, quantitative analysis of specialized satellite and aircraft data, including microwave and hyperspectral sources, will be used to investigate significant environmental questions. Students will refine visual and technical skills for image interpretation, digital image processing, change detection of environmental systems, and presentation of spatial data. Required research project. Must have graduate standing in EES or consent of the instructor.

EES 459 Reconstructing Environmental Change 3 Credits
Lectures, seminars, and in-depth discussion on current issues and selected topics in Quaternary paleoecology and paleoclimatology. Survey of techniques in studying and reconstructing environmental changes and biological responses. Use of multiple proxy data from paleo-archives (e.g., ice cores, lake sediments) to address nature of past climate variability. Quantitative analyses of paleo-records to test paleoecological hypothesis (e.g., multivariate analysis) and to infer possible causes and forcing mechanisms of past climate change (e.g., time series analysis). May include field and laboratory exercises.

EES 471 Stable Isotope Chemistry - Theory, Techniques, and Applications in Earth and Environmental Sciences 3 Credits
Distributions of stable isotopes (primarily of O, H, C, S, and N) in the lithosphere, hydrosphere, biosphere, and atmosphere. Topics include mechanisms of fractionation and mixing, advancements in techniques for extractions and mass spectrometry, and recent applications of stable isotopes in the earth and environmental sciences. Lectures, seminars, laboratory sessions. Consent of instructor required.

EES 473 Aqueous Geochemistry 3 Credits
Advanced study of the equilibria and kinetics of chemical reactions occurring at the earth's surface. A review of concepts in geochemistry including activity, solubility, thermodynamics, kinetics, and oxidation-reduction reactions is followed by readings from the literature. Topics covered depend on student interest, and have included chemical weathering, chemical evolution of surface and groundwater, acid mine drainage, trace element chemistry, biogeochemical cycles, and ocean chemistry. Must have graduate standing in EES or consent of instructor.
Repeat Status: Course may be repeated.

EES 477 Chemical and Geological Oceanography 3 Credits
This course will investigate the pathways that chemical species follow on their transit through the world's oceans, and related geologic processes. Fundamental principles will be combined with quantitative approaches to construct mass balance models across boundaries including the atmosphere, rivers, groundwater, and hydrothermal systems. Chemistry topics, including seawater composition, isotope tracers, ocean circulation, carbonate chemistry and biogeochemical cycling, will be linked with geology topics, including sedimentation and the formation of basaltic crust of the seafloor via igneous petrogenesis and volcanism.

EES 484 Ecosystem Processes 3 Credits
Theoretical and experimental approaches to investigate ecosystem processes at local, regional, and global scales. Emphasis on interactions among physical, chemical, and biotic components of ecosystems. Must have graduate standing in EES.

EES 485 Advanced Topics in Geophysics 1-6 Credits
Intensive study of topics in geophysics not covered in more general courses.
Repeat Status: Course may be repeated.

EES 490 Thesis Research 1-6 Credits
Masters' thesis research directed by research committee. 3-6 credits required for EES M.S. programs. Consent of research advisor required.
Repeat Status: Course may be repeated.

EES 491 Investigations in Earth and Environmental Sciences 1-3 Credits
Research on a special problem; field, laboratory, or library study; report required. Credit above three hours granted only when a different problem is undertaken.

EES 492 Advanced Topics in Modern and Quaternary Processes 3 Credits
Intensive study of topics in modern and Quaternary geology not covered in more general courses.
Repeat Status: Course may be repeated.

EES 493 Advanced Topics in Tectonics 1-6 Credits
Intensive study of tectonic processes and products not covered in more general courses.
Repeat Status: Course may be repeated.

EES 494 Advanced Topics in Ecosystem Ecology 1-6 Credits
Intensive study of ecosystem processes not covered in more general courses.
Repeat Status: Course may be repeated.

EES 496 Advanced Topics in Geochemistry 1-4 Credits
Intensive study of geochemical processes not covered in more general courses.
Repeat Status: Course may be repeated.

EES 497 Advanced Topics in Paleoecology and Paleoclimatology 3 Credits
Intensive study of paleoecology and paleoclimatology not covered in more general courses.
Repeat Status: Course may be repeated.

EES 499 Dissertation Research 1-15 Credits
Ph.D. dissertation research directed by research committee. Consent of research advisor required.
Repeat Status: Course may be repeated.

Eckardt Scholars Program

Program Director: Jenna D. Lay, PhD **(**https://english.cas.lehigh.edu/content/jenna-lay/**) (Stanford University)**

Email: j **(**ar02@lehigh.edu**)**dl210@lehigh.edu **(**jdl210@lehigh.edu**) | Phone: 610-758-3308**

Website: www.eckardtscholars.cas.lehigh.edu **(**https://eckardt-scholars.cas2.lehigh.edu/**)**

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Faculty Steering Committee:

Nandini Deo, PhD (Yale University), Department of Political Science; Wei-Min Huang, PhD (University of Rochester) Department of Mathematics; Jenna Lay, PhD (Stanford University) Department of English; Will Lowry, MFA (UNC Greensboro), Department of Theatre; Lindsey Reuben, PhD (University of Pennsylvania), Department of Modern Languages and Literatures; Vassie Ware, PhD (Yale University) Department of Biological Sciences

The Eckardt Scholars Program is a highly selective and unique honors program in the College of Arts and Sciences. The program emphasizes deep intellectual curiosity, independent work, and close mentoring relationships among the very highest achieving students and faculty at Lehigh. Students in the program are exempt from the Arts & Sciences distribution requirements and work with their major advisor and the Eckardt Scholars Program Director to create a flexible course of study that best suits their academic interests and ambitions. Although exempt from Arts and Sciences distribution requirements, students will complete the requisite number of credits for their degrees and all correlative requirements for their departmental or interdisciplinary majors. The program includes participation in two Eckardt Scholar Seminars, and completion of a large independent project (in the form of a thesis, artistic creation, or other capstone experience) during the senior year.

Courses

ECK 081 Eckardt Scholars Seminar 4 Credits
Seminar for first-year Eckardt Scholars offered during the Fall semester. Consent of program director required.

ECK 281 Eckardt Scholars Seminar 4 Credits
Seminar for Eckardt Scholars offered during the Fall semester. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ECK 282 Independent Study 2-4 Credits
Directed readings for Eckardt Scholars. Requires consent of program director.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ECK 389 Honors Project for Eckardt Scholars 1-8 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. Consent of program director required.
Repeat Status: Course may be repeated.

English

The Department of English has developed a focus on Literature and Social Justice, the outcome of a multi-year effort to revitalize the traditional period-based approach to literary studies. Our classes foster a series of related activities: an exploration of how studying literature contributes to questions of social justice; an immersion in historical periods informed by strong theoretical commitments; an engagement with contemporary literature and culture; and an emphasis on theorized pedagogy, reflective practice, and the scholar-teacher model. Our faculty interact with Lehigh's varied interdisciplinary programs, including Africana Studies; Women, Gender, and Sexuality Studies; Global Studies; Health, Medicine and Society; and Film and Documentary Studies.

UNDERGRADUATE MAJOR IN ENGLISH

Minimum number of hours: 36

The major in English is designed to give students experience in reading analyzing, and formulating thoughts about people and ideas that matter; an understanding of how literary artists find the appropriate words to express their thoughts and feelings; and a basic knowledge of the historical development of British, American, and world literature.

Students who major in English go on to careers in teaching, writing, law, business, science, medicine, engineering--and many others. The analytical and communication skills acquired in the study of literature and writing will be of use in almost any profession or human activity.

Depending on their interests, abilities, and career plans, students who major in English are encouraged to consider double majors or one or two minor fields. The major in English is flexible enough to allow cross-disciplinary study with ease. The student majoring in English chooses from an extensive list of courses. Only one course is required of all students, the introduction to the major, English 100.

To ensure breadth and depth of knowledge, each English major is required to take five courses at the 300 level, typically one in each of the four historical periods listed below[1] and one as an elective. One of the five courses must be designated as WI. Double majors may complete the Writing Intensive (WI) requirement in either major.

The English major requires a minimum of 36 credits.

Required Major Course		
ENGL 100	Working with Texts	4
Breadth Courses [1,2]		**16**
Select a minimum of one course from each concentration below.		
British to 1660		
ENGL 125	British Literature I	
ENGL 327	Major Medieval Writers	
ENGL 328	Topics in Shakespeare	
ENGL 329	Special Topics in Shakespeare and Film	
ENGL 357	Arthurian Legend	
ENGL 358	Outcasts in Medieval Literature and Culture	
ENGL 359	Sinners, Saints, and Heretics	
ENGL 360	Middle English Literature	
ENGL 362	Early Modern Genres and Authors	
ENGL 363	Gender and Sexuality in Early Modern Poetry	
ENGL 364	Special Topics in Early Modern Literature	
British 1660-1900		
ENGL 125	British Literature I	
ENGL 126	British Literature II	
ENGL 331	Milton	
ENGL 361	Jane Austen	
ENGL 366	Topics in British Eighteenth-Century Literature	
ENGL 367	Topics in Transatlantic Eighteenth-Century Literature	
ENGL 368	Transatlantic Radicalism: Can We Remake the World?	
ENGL 369	Romantic-Era Literature	
ENGL 372	Victorian Literature	
American to 1900		
ENGL 123	American Literature I	
ENGL 320	Imagining Freedom: 19th-Century African American Literature and Politics	
ENGL 345	Women and Revolution in Early America	
ENGL 365	Listening to/for Indigenous Voices in the Atlantic World	
ENGL 367	Topics in Transatlantic Eighteenth-Century Literature	
ENGL 368	Transatlantic Radicalism: Can We Remake the World?	
ENGL 373	Early American Literature: Revolution and Nation	
ENGL 376	Topics in Early American Literature	
ENGL 377	American Romanticism	
ENGL 378	Topics in American Realism	
ENGL 381	How Free Can We Be in the Modern World? Realism and Naturalism in American Literature, 1860-1940	
20th and 21st American, British, World, Film, Popular Culture		
ENGL 105	Intro to Latino/a Literature and Culture	
ENGL 124	American Literature II	
ENGL 126	British Literature II	
ENGL 319	Advanced Studies in the Horror Film	
ENGL 325	The Harlem Renaissance: Early 20th-Century African American Literature, Art and Politics	
ENGL 379	Topics in Modern American Literature	
ENGL 380	Contemporary American Literature	
ENGL 384	Contemporary World and Postcolonial Literature	
ENGL 385	Special Topics in Modern British and Irish Literature	
ENGL 387	Film History, Theory, and Criticism	
ENGL 386	Special Topics in Contemporary British Literature	
ENGL 392	Modern American Writing and the Problem of War	
ENGL 393	Modernism, Mourning and Social Justice	
Writing Intensive Requirement [2]		**4**
300-level course designated as Writing Intensive		
Elective Requirements [2]		**12**
Three elective courses are required for the major. These may be taken at any level (provided that the student fulfills the requirement to take at least five 300-level courses total for the major) and may include FILM courses and one course in creative writing (either ENGL 142, 143, 144, 342, 343, or 344).		
Total Credits		**36**

1

A student may use a 100-level survey course in British or American literature (105, 123, 124, 125, or 126) to fulfill one period requirement; however, students must still take a total of five courses at the 300-level.

2

A minimum of five courses must be at the 300-level, one of which must be designated Writing Intensive.

ENGLISH MAJOR WITH CONCENTRATION IN CREATIVE WRITING

Minimum number of hours: 16

To have entered on the transcript *Concentration in Creative Writing,* the students must take:

Select one of the following:		4
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	

Select one of the following:		4
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
Select one of the following: [1]		4
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	
ENGL 170	Amaranth	
ENGL 201	Special Topics in Writing	
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
ENGL 388	Independent Study	
ENGL 483	Creative Writing and Literary Studies	
ENGL 305 & ENGL 306	Creative Writing Thesis Proposal and Creative Writing Thesis	4
Total Credits		**16**

1

Note: the same course cannot fulfill both the core requirement except in the case of courses that can be repeated for credit—ENGL 201, ENGL 342, ENGL 343 and ENGL 344—which can be taken twice, once for core credit and once as an elective.

Note: Additional courses may be offered that meet distribution requirements; please consult departmental course descriptions each semester for these additions.

DEPARTMENTAL HONORS IN ENGLISH

In order to receive departmental honors the English major must attain a 3.5 grade-point average in courses presented for the major and must complete at least 44 credit hours of course work in English (beyond WRT 001 and WRT 002). For the additional credits beyond the 36 required of all English majors, honors students must take the following courses:

ENGL 309	Interpretation: Critical Theory and Practice	4
or ENGL 312	Studies in Literary and Cultural Theory	
or an approved theory course.		
ENGL 305	Creative Writing Thesis Proposal	1
or ENGL 307	Undergraduate Thesis Proposal	
ENGL 306	Creative Writing Thesis	3
or ENGL 308	Undergraduate Thesis	
Total Credits		**8**

Presidential Scholars

Students who anticipate becoming Presidential Scholars should speak to the Director of Graduate Studies in their junior year.

MINORS IN ENGLISH

The Department of English offers three minors, each requiring 16 hours of course work beyond First-Year Writing 1 and 2. Students' are encouraged to take English 100 (Working with Texts) as one of the 4 courses. Students' major advisors monitor the minor programs, but students should consult the minor advisor in the Department of English when setting up a minor program.

MINOR IN ENGLISH

Four Courses in ENGL Literature or Film [1]		16
Total Credits		**16**

1

To minor in English students take 4 courses in ENGL literature or film either offered by or cross-listed with the English Department. One of these four courses must be at the 300-level, and no more than one of these four courses may be in Creative Writing (ENGL 142, 143, 144, 201, 342, 343, or 344).

To minor in creative writing, students take:

CREATIVE WRITING MINOR

Select one of the following:		4
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	
A literature course at the 100- or 300-level.		4
Select one of the following:		4
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
Select one of the following: [1]		4
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	
ENGL 170	Amaranth	
ENGL 201	Special Topics in Writing	
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
ENGL 388	Independent Study	
ENGL 483	Creative Writing and Literary Studies	
Total Credits		**16**

1

Note: the same course cannot fulfill both the core requirements except in the case of a course that can be repeated for credit—ENGL 201, ENGL 342, ENGL 343, and ENGL 344—which can be taken twice, once for core credit and once as an elective.

To minor in writing, students take:

Select one of the following:		4
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	
ENGL 171	Writing for Audiences	
Select one of the following:		4
ENGL 201	Special Topics in Writing	
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
Select two of the following: [1]		8
ENGL 142	Introduction to Writing Poetry	
ENGL 143	Introduction to Writing Creative Non-Fiction	
ENGL 144	Introduction to Writing Fiction	
ENGL 171	Writing for Audiences	
ENGL 201	Special Topics in Writing	
ENGL 342	Advanced Poetry Writing	
ENGL 343	Advanced Creative Non-Fiction	
ENGL 344	Advanced Fiction Writing	
Total Credits		**16**

[1]

Note: the same course cannot fulfill both the core requirements except in the case of a course that can be repeated for credit —ENGL 201, ENGL 342, ENGL 343, and ENGL 344—which can be taken twice, once for core credit and once as an elective.

FIRST-YEAR COMPOSITION REQUIREMENT

WRT 001	Academic and Analytical Writing	3
WRT 002	Research and Argument	3
Total Credits		**6**

GRADUATE WORK IN ENGLISH

The Department of English has developed a focus on Literature and Social Justice, the outcome of a multi-year effort to revitalize the traditional period-based approach to literary studies. Our graduate programs provide students with skills necessary to recognize how literature and other forms of cultural production intervene in questions of justice and shape our conceptions of the world.

The Master of Arts Program

Candidates for the master's degree must complete at least 33 credit hours. Students take at least seven of the required courses at the 400 level but may select the balance of their curricula from 300-level course offerings. Course work for the M.A. must include:

ENGL Literature Courses, pre-1830		6
ENGL Literature Courses, post-1830		6
ENGL Theory Course		3
ENGL Elective Courses [1]		15
ENGL 482	Theories of Literature and Social Justice	3
Total Credits		**33**

[1]

At least 7 courses required at the 400-level; the balance of the curricula from appropriate 300-level course offerings.

This distribution allows for some concentrated study at the master's level. ENGL 485 and ENGL 486, the required courses for new teaching fellows, are not counted in the 33 credits toward the M.A. but will be counted later toward the Ph.D., even if rostered during the M.A. program.

The Doctor of Philosophy Program

The department admits to its doctoral program only students of proven competence and scholarly promise. An average of 3.5 in M.A. course work and strong endorsements from graduate instructors are minimum requirements for acceptance.

Doctoral candidates with a Lehigh master's degree are required to take eight courses and register for 42 credit hours beyond the M.A. Those entering the doctoral program with a master's from another institution are required to take nine courses and register for 48 credit hours.

Candidates must also demonstrate a reading knowledge of one or two foreign languages after having agreed on choices with the director of graduate studies.

No later than six months after completing their course work, candidates will take written and oral examinations in one major field and two minor fields.

Candidates write their dissertations after having their dissertation proposals approved by the department and being admitted to candidacy by the appropriate college.

ENGL Literature and Theory Courses		
ENGL 499	Dissertation [1]	
Total Credits [2]		**42-48**

[1]

Includes Exam Preparation and Dissertation.

[2]

Doctoral candidates with a Lehigh master's degree are required to take eight courses and register for 42 credit hours beyond the M.A. Those entering the doctoral program with a master's from another institution are required to take nine courses and register for 48 credit hours.

Graduate Certificate in Composition and Rhetoric

The Graduate Certificate in Composition and Rhetoric is awarded to students in the M.A. or Ph.D. programs in English when they complete a program of training in the theory and practice of composition-rhetoric consisting of 12 credit hours of course work. At least 8 credits must be in graduate seminars or independent studies: English 480 (3 cr.), 481 (3 cr., topic must be in rhetoric), 485 (2 cr.), 491 (1-3 cr.), or 495 (3 cr.). The other 4 credits may be in seminars, independent studies, and/or any combination of courses in pedagogy, field work, or research: English 486, 487, 488, or 489 (all 1 cr.).

Graduate students in the M.A. program in English will be able to complete the certificate requirements in four semesters alongside their M.A. coursework, by taking a total of 9 or 10 credits each semester; students who proceed from the M.A. to the Ph.D. can spread the courses over additional years. The certificate requires 12 credits of course work. At least 8 credits must be in graduate seminars or independent studies, including English 485 (2 cr, Introduction to Writing Theory); English 480 (3 cr, Composition and Rhetoric); English 481 (3 cr, Theory and Criticism, topic in rhetoric); English 495 (3 cr, Independent Study); or English 491 (1-3 cr, Special Topics in Comp-Rhet); and 4 credits may be in seminars, independent studies, and any combination of 1-credit courses in pedagogy, field work, or research: English 486, 487, 488 (new), and 489 (new), some of which may be repeated for credit.

Sample course of study for M.A. students. Courses for the certificate are italicized and labeled "Comp"; courses for the M.A. in Literature and Social Justice are labeled "Lit."

Fall, Year 1: *Comp: English 485 (2*) Spring, Year 1: Lit: Theories LSJ (3)

Comp: English 486 (1)
Comp: English 480 (3)

Lit: Post-1830 Lit (3)
Lit: Post-1830 (3)

Lit: Pre-1830 Lit (3)
Comp: English 487 (1)

Fall, Year 2: Lit: Pre-1830 (3) Spring, Year 2: Lit: MA Thesis (3)

Lit *& Comp: English 481 Rhet Theory (3)* Lit: Elective (3)

Lit: Elective (3)
Comp: English 488 (1)

Comp: English 487 or 489 (1) Lit: Elective (3)

Literature Courses = 30 credits

Composition-Rhetoric Courses = 12 credits (note that English 481, when offered on a topic in Rhetorical Theory, meets requirements for both M.A. in English and Certificate in Composition and Rhetoric).

UNDERGRADUATE COURSES

ENGL 038, ENGL 089, ENGL 091 are open to all undergraduates, including first-year students also taking freshman English.

Prerequisites: Each literature course is a self-contained unit. Thus, students may roster ENGL 126 whether or not they have had, or ever plan to take, ENGL 125. Creative writing courses may have specific prerequisites as listed below.

Graduate Students taking 300-level courses receive 3 credits; undergraduates receive 4 credits.

GRADUATE COURSES IN ENGLISH

Graduate (400-level) courses are seminars, ordinarily limited to no more than twelve graduate students, but undergraduate English

majors who are planning to go on to graduate school in English and who have shown proficiency in the study of literature may petition to take one of these seminars in their senior year.

English Courses

ENGL 001 Critical Reading and Composition 3 Credits
Introduction to academic writing that supports a claim in respectful conversation with others. Topics drawn from important issues in the world in which students live. The course provides multiple opportunities to engage thoughtfully in the writing process. Students must receive a grade of C- or higher to advance to English 2.

ENGL 002 (WRT 002) Research and Argument 3 Credits
Continuation of ENGL 1. Designed to refine the skills of argument and research. Students will make persuasive, thoughtful, and well-supported arguments in a variety of forms, including multi-modal genres. The course provides a number of occasions to think, research, and write about pressing issues of public concern. Must have a grade of C- or higher in English 1.
Prerequisites: ENGL 001
Attribute/Distribution: ND

ENGL 003 Composition and Literature I for Multilingual Writers 3 Credits
Students improve both their advanced academic written English and academic writing style through a process of reading fiction and non-fiction and by writing well-organized, coherent essays for academics. Author citation, style, and written fluency and accuracy are addressed within students' writing. Enrollment is limited to multilingual English speakers; prior academic writing history, English placement testing, and/or ICAPE director's recommendation determines placement.
Attribute/Distribution: ND

ENGL 005 Composition and Literature II for Multilingual Writers 3 Credits
Continuation of English 3. Students practice more advanced methods and modes of writing for academics, including writing and reading for their specific field of study. Students continue to work on advanced written fluency and accuracy of idiomatic language and expression and are taught advanced methods of author citation and source integration.
Prerequisites: (ENGL 003)
Attribute/Distribution: ND

ENGL 011 Seminar in Critical Reading & Writing 3 Credits
English 11 is designed to deepen your skills in critical reading and writing through a close engagement with literary and cultural texts and advanced training in best writing practices. You will make persuasive, thoughtful, and well-supported arguments in a variety of forms.
Prerequisites: AP English Language Comp with a score of 4 or higher or AP English Literature Comp with a score of 4 or higher or SAT Evidence-based Read/Write with a score of 700 or higher or IB English HL with a score of 5 or higher or ACT Writing Subject Score 2016 with a score of 8 or higher or ACT Raw Verbal (English) with a score of 32 or higher or (SAT Essay Reading Subscore with a score of 6 or higher and SAT Essay Analysis Subscore with a score of 6 or higher and SAT Essay Writing Subscore with a score of 6 or higher)

ENGL 012 University Life and Language 1,3 Credits
This course is part of the Virtual College Success Academy. It is online (one credit for graduate students and three credits for undergraduate students) in which students learn about university culture, develop their academic communication and study skills, and engage virtually with Lehigh teachers, staff, and students on campus. As a final group project, students will collaborate virtually on an e-portfolio with research and present virtually to the class and invited guests.

ENGL 015 Speech Communication for International Students 1 Credit
This course introduces students from other countries to American academic speaking contexts, such as attending office hours, participating spontaneously in class discussions, and giving multi-modal presentations. In the course, students learn about university culture while improving study skills and intercultural communication. Interactions with students, staff, and faculty at Lehigh are a key part of the class.
Attribute/Distribution: ND

ENGL 016 Critical Reading and Composition Recitation 1 Credit
For multilingual speakers of English taking English 001, Business 003, or other writing-intensive courses. This recitation class will give students a space to ask questions about English grammar, American rhetorical conventions, academic genres, and the writing process in a small class setting.
Repeat Status: Course may be repeated.

ENGL 017 Research and Argument Recitation 1 Credit
For multilingual speakers of English taking English 002, Business 003, or other writing-intensive courses. This recitation class will give students a space to ask questions about English grammar, American rhetorical conventions, academic genres, and the writing process in a small class setting.
Repeat Status: Course may be repeated.

ENGL 018 Business Communication Recitation 1 Credit
For multilingual speakers of English taking BUS 003. This recitation class will give students a space to ask questions about English grammar, genres, and business writing in a small class setting.
Corequisites: BUS 003

ENGL 038 (AAS 038) Introduction to African Literature 3 Credits
Sub-Saharan African literary themes and styles; historical and social contexts, African folktales, oral poetry, colonial protest literature, postcolonial writing, and films on contemporary Africa.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 045 Conspiracy and Paranoia 4 Credits
Conspiracy theories seem to be everywhere these days--everywhere, of course, except in our own heads. Why does everybody else seem so paranoid? Can we tell an actual conspiracy from a crazy conspiracy theory? This class will use recent literature and some films to explore why everybody resorts to conspiratorial thinking and paranoid explanations for events large and small.
Attribute/Distribution: CC, HE, W

ENGL 060 (THTR 060) Dramatic Action 4 Credits
How plays are put together; how they work and what they accomplish. Examination of how plot, character, aural and visual elements of production combine to form a unified work across genre, styles and periods. Recommended as a foundation for further studies in design, literature, or performance.
Attribute/Distribution: CC, HE, HU, W

ENGL 065 (THTR 065) Introduction to Playwriting 4 Credits
An introduction to writing for the stage, with an emphasis on creating characters, exploring story and structure, experimenting with theatrical language, and working within the context of theatrical history and the wider world. This course combines in-class exercises with seminar-style discussion of the student's work.
Attribute/Distribution: AL, CC, HU, W

ENGL 066 (FILM 066) The Slasher 4 Credits
The slasher has been one of the most enduring subgenres of horror, evolving and continuing to thrive since 1978's Halloween. In this course, we will read some of the most important critical discussions of the slasher and watch films, from the 70s to the present, that embody both the core characteristics of the subgenre and its radical innovations. We will address what the slasher is, why it's remained so popular, and what ethical and political questions it raises.
Attribute/Distribution: HE, HU, W

ENGL 089 Popular Literature 4 Credits
The form of literature that has been designated in one way or another as "popular," such as folklore and detective fiction. May be repeated for credit as content changes. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 091 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 100 Working with Texts 4 Credits
A course to help students to become, through intense practice, independent readers of literary and other kinds of texts; to discern and describe the devices and process by which texts establish meaning; to gain an awareness of the various methods and strategies for reading and interpreting texts; to construct and argue original interpretations; to examine and judge the interpretations of other readers; to write the interpretive essay that supports a distinct position on some literary topic of importance; and to.
Attribute/Distribution: HE, HU, W

ENGL 102 (AAS 102, JST 102, REL 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: CC, HE, HU, W

ENGL 104 (WGSS 104) Special Topics in Gender Studies 4 Credits
This course will involve extended study in a sub-area of English language culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 105 (LAS 105) Intro to Latino/a Literature and Culture 4 Credits
This course provides an overview of the literary history and criticism of Latino/a literature and media. Through a combination of critical and literary theory, we will focus on works Latino/a-centered texts including poetry, prose, film, and television which portray issues of migration/immigration, colonialism, history, race, and gender. We will also examine the role of literature in the development of Latino/a Studies. Authors and scholars featured in the course include José Martí, Pura Belpré, Pedro Pietri, the Young Lords Party,.
Attribute/Distribution: HU

ENGL 115 (HMS 115) Topics in Literature, Medicine, and Health 4 Credits
Largely focused on narratives about health, illness and disability, this course will examine individual experiences with attention to social context. Topics may include the physician/patient relationship, illness and deviance, plague literature, gender and medicine, autism, AIDS, mental illness, aging.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 119 (FILM 119) Introduction to the Horror Film 4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self-reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called torture porn" to the return of the "possession" film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 120 Literature from Developing Nations 4 Credits
Contemporary literature from Africa, Central America, South America, or Asia. Must have completed six hours of freshman English. Cannot be taken pass/fail.
Attribute/Distribution: HE, HU, W

ENGL 121 (AAS 121) Topics in African-American Literature 4 Credits
Selected works of African American literature and/or the literatures of the African diaspora. Must have completed six hours of first-year English. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 123 American Literature I 4 Credits
Masterpieces of American literature from the 17th through the mid-19th century.
Attribute/Distribution: HE, HU, W

ENGL 124 American Literature II 4 Credits
Masterpieces of American literature from the middle of the 19th century to the present.
Attribute/Distribution: CC, HE, HU, W

ENGL 125 British Literature I 4 Credits
British literature and literary history from Beowulf through the Pre-Romantics.
Attribute/Distribution: CC, HE, HU, W

ENGL 126 British Literature II 4 Credits
British literature and literary history from the Romantic period into the 20th century.
Attribute/Distribution: HE, HU, W

ENGL 127 (THTR 127) History of Theatre I 4 Credits
A multi-cultural survey of dramatic literature and theatrical practice from its ritual origins to the 18th century.
Attribute/Distribution: CC, HE, HU

ENGL 128 (THTR 128) History of Theatre II 4 Credits
A multi-cultural survey of dramatic literature theatre and theatrical practice from the 18th century to the present day.
Attribute/Distribution: CC, HE, HU, W

ENGL 132 (FILM 132, WGSS 132) Viewing Mad Men: Window, Mirror, Screen 4 Credits
Widely considered one of the best TV shows ever made, Mad Men demonstrated that television serial drama could combine virtuoso storytelling, cinematic visual style and historical ambition. Set in a New York ad agency in the 1960s, Mad Men both opens a window onto the past and holds a mirror up to the present. We will analyze Mad Men’s innovative visual and narrative style and explore two core themes: shifting gender roles and the influence of advertising in U.S. society.
Attribute/Distribution: HE, HU

ENGL 135 Playwriting II 4 Credits
For students interested in continuing and deepening their writing for the stage. Instructor approval required.
Attribute/Distribution: AL, HU, W

ENGL 138 (AAS 138) Introduction to African American Literature 4 Credits
Survey of African American prose narrative and poetry from the 18th century to the present. Features writers from the Harlem Renaissance, the Black Arts Movement, and the post-Black Power era.
Attribute/Distribution: HE, HU, W

ENGL 142 Introduction to Writing Poetry 4 Credits
Instruction in the craft of writing poetry, with a focus on prosody. Practice in and classroom criticism of poems written by students taking the course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU, W

ENGL 143 Introduction to Writing Creative Non-Fiction 4 Credits
Practice in writing non-fiction from immediate experience, with emphasis on accurate, persuasive description writing. Must have completed six hours of freshman English.
Attribute/Distribution: AL, HU, W

ENGL 144 Introduction to Writing Fiction 4 Credits
Instruction in the craft of writing fiction. Practice in and classroom criticism of stories written by students taking the course.
Attribute/Distribution: AL, HU, W

ENGL 147 (FILM 147, WGSS 147) Made to Kill: Female Violence in Popular Film 4 Credits
Heroes. Monsters. Outlaws. Catsuits. In the wake of the second-wave feminist movement, U.S. films in the horror, thriller, and action/adventure genres began to represent women as perpetrators of violence more frequently and in new ways. This course examines how iconic films from the last four decades, such as The Silence of the Lambs, Alien, The Hunger Games and Wonder Woman, have both reflected and shaped the ongoing cultural debate about gender, sexuality and power.
Attribute/Distribution: HE, HU

ENGL 149 (FILM 149, WGSS 149) Sexbots and Terminators: Cinematic Fantasies of the Intelligent Machine 4 Credits
For decades, film and television narratives have represented human relationships with robots to explore existential issues in human life: love, sex, mortality, labor, domination, exploitation. Could robots solve the difficulties of human intimacy? Could artificial intelligence enable us to cheat death? What do sex robots reveal about misogyny? Why are human/AI relationships so frequently imagined in Western narratives as master/slave relationships? Films and TV shows may include The Matrix, Ex Machina, Her, Terminator 2, Black Mirror and Westworld.
Attribute/Distribution: HE, HU, W

ENGL 151 (FILM 151, GS 151) Global Cinema 4 Credits
This course introduces students to contemporary filmmakers from Asia and Africa who have been inspired by globalization, dealing with issues such as mass migration, ethnic conflict and civil war, transnational finance and technology, and ongoing social and economic inequities. The course will be divided into four geographical units, with a representative mix of art films, popular genres (Bollywood and Nollywood), and global science fiction and horror. Filmmakers may include Mira Nair, Farah Akhtar, Bong Joon-ho, and Asghar Farhadi, among others.
Attribute/Distribution: CC, HE, HU, W

ENGL 154 (FILM 154, WGSS 154) What Does Creativity Look Like? Documentary Visions 4 Credits
What can documentary films tell us about creativity? What is it and why does it matter? This course takes an intersectional approach to creativity, centering the role of gender, sexuality, race and class in the lives and work of the artists and activists represented in the course films. We will also analyze the creative visual and narrative strategies these documentaries employ to shape the stories they tell. Students will have an opportunity to document the creativity of their own communities.
Attribute/Distribution: HE, HU

ENGL 155 The Novel 4 Credits
Selected novels, with attention to such matters as narrative, characterization, and cultural context.
Attribute/Distribution: HE, HU, W

ENGL 157 Poetry 4 Credits
Selected traditional and modern poetry, with attention to voice, form, and cultural context.
Attribute/Distribution: HE, HU, W

ENGL 162 (FILM 162) How to Watch Movies Like a Hollywood Screenwriter 4 Credits
A course about screenplays: their history, their role in the film industry, and the books that promise to teach screenwriters the tricks of the trade. After reading excerpts from the most influential screenwriting books of the last 40 years, students will be able to identify the "Hollywood Model" of screenplay conventions regarding character, plot structure, and genre. They will also learn how to write critically about how these conventions have shaped assumptions about race, gender, and international audiences.
Attribute/Distribution: HE, HU, W

ENGL 163 (FILM 163) Topics in Film Studies 4 Credits
History and aesthetics of narrative film. May be repeated for credit as subject varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 170 Amaranth 1 Credit
Amaranth editorial staff. Students can earn one credit by serving as editors (literary, production, or art) of Lehigh's literary magazine. Work includes soliciting and reviewing manuscripts, planning a winter supplement and spring issue, and guiding the magazine through all phases of production. Editors attend weekly meetings with the faculty advisor. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL

ENGL 171 Writing for Audiences 4 Credits
Practice in writing in a variety of discourse modes for different audiences. Consideration of the role of style, clarity, and careful observation in writing. Course may be repeated as topics vary.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, W

ENGL 175 Individual Authors 4 Credits
Intensive study of the works of one or more literary artists, such as Jane Austen, Ernest Hemingway, or Toni Morrison. May be repeated for credit as writers and texts vary.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 177 Individual Works 4 Credits
Intensive study of one or more literary works, such as Moby Dick, and study of other major texts such as the Bible with attention to literary form.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 179 Rhetoric of Humor 4 Credits
You'll learn the building blocks of humor by reading relevant theories from Plato, Aristotle, Kant, and Freud (among others), each of whom offers a different perspective on what causes people to laugh. Then you will put these ideas to the test by applying them to humorous texts of all kinds: stand-up comedy, TV and film clips, and humorous essays. In addition, you'll devote part of each week to short creative exercises meant to help you find your own comedic voice.
Attribute/Distribution: HE, W

ENGL 183 Independent Study 1-4 Credits
Individually supervised study of a topic in literature, film, or writing not covered in regularly listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ENGL 187 Themes in Literature 4 Credits
Study of a theme as it appears in several works of literature, such as Love in the Middle Ages.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 189 Popular Literature 4 Credits
Literature that has been designated in one way or another as "popular," such as science fiction or graphic narrative.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 191 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 201 Special Topics in Writing 1-4 Credits
Approaches not covered in other writing courses. Individual projects.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ENGL 202 (GS 202, LAS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HE, HU

ENGL 282 Professional Internship 1-4 Credits
Individualized work experience, on- or off-campus, in a field that a student of English wishes to explore as a career. Before registering, a student must meet with the internship adviser and obtain departmental approval. Internship credits do not count toward major in English. Sophomore standing and departmental approval required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ENGL 291 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ENGL 301 Topics in Literature 3-4 Credits
A theme, topic, or genre in literature, such as autobiography as literature and the gothic novel.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 302 (GS 302, LAS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including “fantastic” narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: CC, HU

ENGL 303 (FILM 303, GERM 303, MLL 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany as well as Europe and America. Versions of "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in films and many forms of world literature. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: CC, HE, HU, W

ENGL 304 (WGSS 304) Special Topics in Gender Studies II 3,4 Credits
This course will involve extended study in a sub-area of English language, culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 305 Creative Writing Thesis Proposal 1 Credit
Preparation to write creative thesis. Requirements include writing a proposal and bibliography.
Attribute/Distribution: W

ENGL 306 Creative Writing Thesis 3 Credits
Portfolio of original creative work in poetry, fiction, or creative non-fiction, plus introductory researched essay. Required for concentration in creative writing.
Attribute/Distribution: HU, W

ENGL 307 Undergraduate Thesis Proposal 1 Credit
To be enrolled by senior honors students preparing to write honors thesis. Requirements include conducting preliminary research for the thesis and writing a detailed thesis proposal and bibliography. May not be rostered concurrently with English 308.
Attribute/Distribution: HU, W

ENGL 308 Undergraduate Thesis 3 Credits
Open to advanced undergraduates who wish to submit theses in English. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ENGL 309 Interpretation: Critical Theory and Practice 3-4 Credits
Introduction to recent literary and cultural theory, such as New Criticism, Structuralism, Marxism, Psychoanalytic approaches, Reader-response Criticism, Deconstruction, Feminist Theory, New Historicism, and Cultural Criticism.
Attribute/Distribution: HE, HU, W

ENGL 310 Introduction to Teaching English to Speakers of Other Languages 3,4 Credits
An introduction to Teaching English to Speakers of Other Languages (TESOL) including the theory and principles of second language acquisition, ESL methods, materials, and current trends. Students will learn to plan and teach an ESL/EFL class in the four skills as well as integrated skills, choose appropriate materials for varying age and proficiency levels, and identify key issues in the role of global Englishes. Required classroom observing hours and teaching demonstration(s).
Attribute/Distribution: HU

ENGL 311 (WGSS 311) Representations of Gender and Sexuality 3-4 Credits
This course explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. How do female and male writers envision what it means to be a “woman” or to be a “man” at various moments in history and from various places around the world? How have gendered (and sexed) identities been shaped in various constraining and empowering ways in the literary imagination? What specifically gendered issues (such as love and violence) have been represented in literature?
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 312 Studies in Literary and Cultural Theory 3,4 Credits
Study of a particular contemporary theoretical approach to literature, film, or other cultural texts. .
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 314 Teaching English as a Second Language: A Practicum 1-4 Credits
Companion to English 310 (Intro to Methods of English as a Second Language). This course will include class meetings that focus on guided discussions of the practical application of principles and practices of ESL pedagogy in a real-world environment. Supervised ESL classroom student teaching required.
Prerequisites: ENGL 310
Attribute/Distribution: ND

ENGL 315 (HMS 315) Topics in Literature, Medicine, and Health 3-4 Credits
Analyzing the stories people tell about health, illness and disability, this course engages cultural studies approaches in order to explore the way those stories are told. Topics may include: illness and the graphic novel, the changing image of the healer in literature, collaborative storytelling with Alzheimer's patients, end of life narratives, tales from the ER, narrative ethics.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 316 (GS 316) Native American Literature 3-4 Credits
This course is a survey of the literary texts written by the indigenous inhabitants of what is now the United States, beginning with the myths and legends of the era before European contact and ending with the novels, poems, and films produced by Native Americans in the twentieth- and twenty-first centuries.
Attribute/Distribution: HE, HU, W

ENGL 317 (REL 317) Topics in Jewish Literature 3-4 Credits
Selected topics in Jewish literature, which may include: Contemporary Jewish Literature, Philip Roth's Complaint, and Jewish Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 318 (AAS 318) Topics in African American Literature and Culture 3-4 Credits
Topics in African-American culture and/or the cultures of the African diaspora. Topics may be focused by period, genre, thematic interest or interdisciplinary method including, for example, Nineteenth-century African-American Literature and Politics; African-American Folklore; Black Atlantic Literature; The Harlem Renaissance; and African-American Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 319 (FILM 319) Advanced Studies in the Horror Film 3-4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called "torture porn" to the return of the "possession" film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 320 (AAS 320) Imagining Freedom: 19th-Century African American Literature and Politics 3-4 Credits
In the midst of slavery and its violent aftermath, African Americans dreamed of freedom. These imaginings of freedom are among the richest cultural legacies of the American people and a necessary part of any effort to understand our nation's contradictory history. Students will read slave-narratives, novels, poems, protests against slavery and lynching, demands for political rights and women's equality, calls for slave rebellion and appeals for inter-racial cooperation. Readings include Frederick Douglass, Harriet Jacobs, Sojourner Truth, Harriet Wilson, Charles Chesnutt.
Attribute/Distribution: CC, HE, HU, W

ENGL 325 (AAS 325) The Harlem Renaissance: Early 20th-Century African American Literature, Art and Politics 3-4 Credits
Explore the extraordinary flowering of African American literary, artistic and political life in the early 20th century. Study masterpieces of African American literature, music, visual art, and political imagination. Consider how artists and activists represented the diversity of Black life in America and reimagined race relations during the Jim Crow era. Learn how works by Langston Hughes, Zora Neale Hurston, Bessie Smith, Aaron Douglas and many others can assist us in realizing the promise of racial justice.
Attribute/Distribution: CC, HE, HU, W

ENGL 327 Major Medieval Writers 3-4 Credits
Study of major medieval writers. Titles include The Canterbury Tales; Early Chaucer and the Continental Tradition, and Langland's Piers Plowman.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 328 (THTR 328) Topics in Shakespeare 3-4 Credits
This class explores why Shakespeare's plays and poems still resonate today. We will focus in particular on how Shakespeare's plays have been used to explore questions of gender, race and social class. We'll read some of the "greatest hits" as well as a few lesser-known works, focusing first on how these texts were understood in the time they were written and then on why and how they inform our perspective today.
Attribute/Distribution: CC, HE, HU, W

ENGL 329 Special Topics in Shakespeare and Film 3-4 Credits
This course explores how Shakespeare's plays have been adapted into film. Despite being most celebrated for his language, Shakespeare's work has been translated into the visual medium of cinema since the era of silent film -- and his popularity shows no sign of slowing down. The course pairs plays with multiple film adaptations, which use Shakespeare to explore contexts including Feudal Japan, Soviet Russia, Wall Street, and more.
Attribute/Distribution: CC, HE, HU, W

ENGL 331 Milton 3-4 Credits
An introduction to John Milton's poetry and prose emphasizing close reading and cultural contexts. Half of the course will be devoted to Paradise Lost, and particular attention will be paid to politics, religion, and gender.
Attribute/Distribution: CC, HE, HU, W

ENGL 341 (EVST 341) Contemporary US Literature of Environmental Crises 3-4 Credits
This course addresses how contemporary US literature depicts toxic America and the environmental crises as well as the human (and other animal) tragedies that result from a variety of contemporary practices that deny connectivity to/dependence upon ecosystems. Students will engage with some of the most important novels written in the contemporary period that call readers to address human impact on the environment, to imagine alternative & less ruinous ways of being in the world, and to imagine more sustainable futures.
Attribute/Distribution: CC, HE, HU, W

ENGL 342 Advanced Poetry Writing 3-4 Credits
An intensive writing workshop in which student poems and related literary texts receive close reading and analysis.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 142
Attribute/Distribution: AL, HU, W

ENGL 343 Advanced Creative Non-Fiction 3,4 Credits
Practice of the essay, including such forms as the personal, academic, or argumentative essay. Emphasis on developing a strong personal voice and learning to use other voices. Intensive revision. Permission of writing minor advisor.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 143
Attribute/Distribution: AL, HU, W

ENGL 344 Advanced Fiction Writing 3-4 Credits
An intensive writing workshop in which student stories and related literary texts receive close reading and analysis. Consent of writing minor advisor.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 144
Attribute/Distribution: AL, HU, W

ENGL 345 (WGSS 345) Women and Revolution in Early America 3-4 Credits
This course explores how opportunities and possibilities for women transformed (or remained the same) during the long eighteenth century. Which early American women could participate in public life and under what circumstances? Did early American values such as liberty and independence extend to women—and to which women? Which women, if any, felt like they had a "revolution" in 1776? Captivity narratives, poetry, novels, and other public writing by early American women will help us explore these issues.
Attribute/Distribution: CC, HE, HU, W

ENGL 350 (LAS 350) Special Topics in Latino Studies 3-4 Credits
Selected works by Latinx Diaspora writers, poets, and artists. Course engages with an ethnic studies framework and approach to texts in terms of U.S. canon formation with attention to race, class, gender, language, and nationality. No prerequisite.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ENGL 357 Arthurian Legend 3-4 Credits
King Arthur had a powerful hold on the popular imagination for more than a thousand years, from Geoffrey of Monmouth's twelfth-century History of the Kings of Britain to Tracy Deonn's twenty-first-century novel Legendborn. In this course, we consider how reinventions of Arthurian legends both reflect and shape the values of their time—with a particular focus on gendered and classed norms of ethical behavior; ideals of justice, leadership, and the rule of law; and notions of nationality and ethnicity.
Attribute/Distribution: CC, HE, HU, W

ENGL 358 Outcasts in Medieval Literature and Culture 3-4 Credits
This course investigates how late medieval English writing features multiple types of outcasts including lepers, beggars, heretics, religious recluses, and so-called lunatics. How do these categories of exclusion function both to critique and to promote forms of hierarchy that privilege men over women, the rich over the poor, the faithful over the heretic, and the sane over the mentally ill? How do current social, ethical, and political ideals create categories of exclusion that potentially resonate with the premodern past?
Attribute/Distribution: CC, HE, HU, W

ENGL 359 Sinners, Saints, and Heretics 3-4 Credits
Exploring how religion is linked to issues of gender, power, and identity, this course investigates the fascinating complexities of Christian belief and practice in medieval England. How does a culture that idealizes social unity come to justify the burning of heretics? How does it arrive at distinctions between perfect virgins and ordinary wives, between holy mendicants and slothful beggars? How do such identifications map on to current understandings of social identity and institutional power?
Attribute/Distribution: CC, HE, W

ENGL 360 Middle English Literature 3-4 Credits
Major literary works of the Middle English period by authors other than Chaucer. Emphasis on Piers Plowman, the Gawain/ Pearl Poet, and the metrical romances.
Attribute/Distribution: CC, HE, HU, W

ENGL 361 (WGSS 361) Jane Austen 3-4 Credits
This course explores the writings, culture, and afterlives of Jane Austen, often considering the interrelations of Austen's novels with various adaptations and variations of her stories. Students explore the efficacy, complexity, and social impact of Austen's works through a variety of critical approaches to ask different questions about slavery and abolition, the French Revolution, British imperialism, and women's equality.
Attribute/Distribution: HE, HU, W

ENGL 362 Early Modern Genres and Authors 3-4 Credits
An examination of a sixteenth- or seventeenth-century author (such as Edmund Spencer, Margaret Cavendish, John Webster, or Thomas Middleton) or an exploration of a literary genre (such as utopian fiction, epic poetry, sonnets, revenge drama or romantic comedy) in its historical and cultural context. See course schedule for specific descriptions and titles.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 363 (WGSS 363) Gender and Sexuality in Early Modern Poetry 3-4 Credits
In sixteenth- and seventeenth-century England, poetry was a culturally significant literary form in which authors explored a range of pressing issues. Our readings will be drawn from canonical and non-canonical authors, and we will pay attention to how poetic form intersects with explorations of gender and sexuality. This study of gender and sexuality in the poetry of one historical period will enable us to think more broadly about how literary texts participate in—and help to shape—social and cultural norms.
Attribute/Distribution: CC, HE, HU, W

ENGL 364 Special Topics in Early Modern Literature 3-4 Credits
An exploration of a specific topic in sixteenth- and seventeenth-century literature, such as gender, sexuality, religion, race, popular culture, or politics. See course schedule for specific descriptions and titles.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 365 Listening to/for Indigenous Voices in the Atlantic World 3-4 Credits
This course explores writing by and about Native Americans on both sides of the eighteenth-century Atlantic. We will discuss topics such as settler colonialism, indigenous agency, the "Last of …" trope, religion, and violence. Texts will include captivity narratives, early novels, memoirs, political writing, and other literary forms produced from the 1680s to the 1830s.
Attribute/Distribution: CC, HE, HU, W

ENGL 366 Topics in British Eighteenth-Century Literature 3-4 Credits
The poetry, drama, fiction, and non-fictional prose of the long eighteenth century (1660-1800), with particular attention to how writers are shaped by and engage with the cultural issues of their time.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 367 Topics in Transatlantic Eighteenth-Century Literature 3-4 Credits
The poetry, drama, fiction, and non-fictional prose written in Britain and the Americas during the long eighteenth century (1660-1800), with particular attention to the transatlantic circulation of texts and ideas.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 368 Transatlantic Radicalism: Can We Remake the World? 3-4 Credits
In the 1790s, anything seemed possible to some writers on both sides of the Atlantic. "The earth was all before me," Wordsworth wrote. Some novelists envisioned remaking the world, though their efforts to create new societies rarely treated all men and women equally. These progressive efforts, moreover, led other writers to struggle to hold in place a world that they felt was spiraling out of control.
Attribute/Distribution: CC, HE, HU, W

ENGL 369 Romantic-Era Literature 3-4 Credits
This study of British Literature and Culture of the Romantic Era (1780-1830) will address specific questions of genre, theme or historical developments. Readings may cover issues such as slavery and abolition, the effect of the French Revolution on British Literature, the rights of women, scientific innovation, ethics, landscape aesthetics, and the gothic.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 372 Victorian Literature 3-4 Credits
This study of British Literature and Culture of the Victorian Age (1830-1901), including the Empire, will address specific questions of genre, theme, or historical developments. Readings may cover issues such as industry, imperialism, the cult of domesticity, aesthetics, the Woman Question, the Reform Acts, the place of the art and the artist, and modern nationalism.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 373 Early American Literature: Revolution and Nation 3-4 Credits
This class explores how early American novelists and poets—men and women, free and enslaved—thought about the revolutionary ideas that had founded the nation. How do novels and poetry think about liberty and freedom? How do they balance the claims of individuals and the claims of the community? How do they define the "people" or the "nation"—and who gets excluded from these categories?
Attribute/Distribution: HE, W

ENGL 375 Major Authors 1-4 Credits
The works of one or more major literary figures studied in depth.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 376 Topics in Early American Literature 3-4 Credits
American literature from settlement until the 1820s, emphasizing fiction, poetry, and non-fiction that helped form and contest American identities and national consciousness.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 377 American Romanticism 3-4 Credits
Literature from the antebellum United States viewed through the literary practices of sentimentalism (an ethos that values sympathy, empathy, and human contact) and the sublime (an aesthetic that attempts to create within readers a sense of the awe-inspiring, otherworldly, and terrifying aspects of life), as well as social conflicts over race, class, and gender.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 378 Topics in American Realism 3-4 Credits
Topics in American literature from the Civil War to the early twentieth century. Topics may include the evolution of literary genres and movements, including realism and naturalism. Authors may include Twain, Davis, Howells, Harper, James, Chesnutt, Jewett, Chopin, Norris, Crane, Du Bois, Gilman, Wharton, Cahan, Olsen and Wright.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 379 Topics in Modern American Literature 3-4 Credits
Topics in American literature before World War II. Topics may be focused by genre, thematic interest, mode of theoretical inquiry or interdisciplinary method, including, for example, Modernism and Mourning; The Harlem Renaissance; Modernism and Social Justice.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 380 Contemporary American Literature 3-4 Credits
Topics in American literature since World War II. Lectures and class discussions of new writers and of recent works of established writers organized around various themes of import for the contemporary period.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 381 How Free Can We Be in the Modern World? Realism and Naturalism in American Literature, 1860-1940 3-4 Credits
Realist and naturalist novelists wondered if Americans were becoming more or less free. Was moral choice possible in a capitalist society devoted to money-making? Could African Americans achieve equality or was racism irreversible? Could women claim new forms of social, professional and sexual freedom – or was male dominance inescapable? Read masterpieces of realist and naturalist fiction and essays by Marx and Freud that changed the modern world. Students will explore the extent and limits of freedom in own lives.
Attribute/Distribution: CC, HE, HU, W

ENGL 384 Contemporary World and Postcolonial Literature 3,4 Credits
Topics in contemporary world literature after 1960, engaging the history and legacy of European colonialism. Topics might include: African Literature; South Asian Literature; Caribbean Literature; and Literature of Globalization.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 385 Special Topics in Modern British and Irish Literature 3-4 Credits
Topics in British and Irish literature before World War II. Topics might include: British Modernism; James Joyce; Virginia Woolf and Bloomsbury; Modern Irish literature; East Meets West: British and Colonial Travel Writing; and Gender and Sexuality.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 386 Special Topics in Contemporary British Literature 3-4 Credits
Topics in post-1945 British literature, including postmodernism and multicultural writing. Topics may include Black British Writing; Immigrant Literature; Gender and Sexuality; Travel Writing; and British Postmodernism.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 387 (FILM 387) Film History, Theory, and Criticism 3-4 Credits
Study of film with the focus on particular genres, directors, theories, periods, or topics. Weekly film screenings. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

ENGL 388 Independent Study 1-4 Credits
Individually supervised study of a topic in literature, film, or writing not covered in regularly listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ENGL 389 Honors Project 1-8 Credits
By consent of department.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

ENGL 391 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

ENGL 392 Modern American Writing and the Problem of War 3-4 Credits
America has been at war continuously since 9/11 and almost continuously since the late 19th century. Explore writings by American novelists and poets (Twain, Hemingway, Cather, Dos Passos, Wright, H.D., and others) who revealed the catastrophic effects of modern warfare on our society. Study visionary political writings by early 20th-century activists who believed that economic justice and racial and gender equality required the abolition of war. Students will consider the relevance of these works to the challenges we face today.
Attribute/Distribution: CC, HE, HU, W

ENGL 393 Modernism, Mourning and Social Justice 3-4 Credits
Loss and disappointment come to us all. If we cannot mourn, we cannot heal or grow. Students will read American modernist masterpieces by Hemingway, Faulkner, H.D., Ellison and others. These writers explored intimate experiences of grief, like romantic disappointment or the death of a loved one. They also invented strategies for mourning collective injuries, like those inflicted by dynamics of racism, misogyny, and economic exploitation. Students will explore their own experiences of loss and develop strategies for sustaining political hope.
Attribute/Distribution: CC, HE, HU, W

ENGL 400 Supervised Teaching 1 Credit
Practical experience in teaching through assisting a faculty teacher in conduct of a regularly scheduled undergraduate course. Open only to graduate students with at least one semester of graduate course work at Lehigh University and a GPA of at least 3.5. Usually rostered in conjunction with 485. Consent of department required.

ENGL 411 (WGSS 411) Gender and Literature 3 Credits
This seminar explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. Content changes each semester.
Repeat Status: Course may be repeated.

ENGL 433 Medieval Genres and Authors 3 Credits
This course examines major Middle English authors (Chaucer, Langland, the Pearl-poet) or genres of Middle English writing (romance, dream vision, drama) in their historical and literary contexts. Individual titles include: Medieval Drama, Chaucer's Literary Circles, Langland: Tradition and Afterlife, and Dream Visions and Revelations.
Repeat Status: Course may be repeated.

ENGL 435 Topics in Medieval Literature 3 Credits
This course explores a thematic topic in medieval literature. Typically, this course challenges traditional conceptions of literary historical periods by spanning Anglo-Saxon and late-medieval texts or late-medieval and early modern texts. Individual titles include: Writing, Rebellion, and Reform: Medieval Literature of Dissent; Poverty and Property, 1350-1650; Sex, Gender, and Sexuality in the Middle Ages; Imagining this Island: Nation and Identity, 800-1400.
Repeat Status: Course may be repeated.

ENGL 439 Early Modern Genres and Authors 3 Credits
Examination of major sixteenth- and seventeenth-century authors or distinctive Renaissance genres in their historical and cultural contexts. Individual courses may focus on authors such as Shakespeare, Milton, Spenser, or Jonson, or genres such as utopian fiction, psalms and sonnets, or city comedy.
Repeat Status: Course may be repeated.

ENGL 441 Early Modern Literature 3 Credits
This course explores a thematic topic in sixteenth- and seventeenth-century English literature. Individual titles may include: Dealing with Difference in Early Modern England; Gender and Catholicism in Early Modern England; Literature of City and Court; Poetry, Politics, and Prophecy: Writing of the English Civil War.
Repeat Status: Course may be repeated.

ENGL 442 British Eighteenth-Century Literature 3 Credits
This course explores British poetry, drama, fiction, and non-fictional prose written during the long eighteenth century (1660-1800). Topics may be organized by period, genre, thematic interest or interdisciplinary method. Individual titles may include: Money, Sex, and Selves; The Rise of the Novel; Witchcraft and History; Conspiracy Theory and Eighteenth-Century Literature.
Repeat Status: Course may be repeated.

ENGL 443 Transatlantic Eighteenth-Century Literature 3 Credits
This course explores the transatlantic circulation of texts and ideas during the long eighteenth century (1660-1800). Topics may be organized by period, genre, thematic interest or interdisciplinary method. Individual titles may include: The Colonial Rise of the Novel; Writing for a Cause; Transatlantic Eighteenth-Century Paranoia.
Repeat Status: Course may be repeated.

ENGL 445 British Romantic-Era Literature 3 Credits
The seminar will explore a focused topic in British Literature and Culture of the Romantic Era (1780-1830) taking into account larger historical, aesthetic, and theoretical concerns. Topics may include slavery and abolition, the cult of childhood, women's writing, imperialism, the gothic, the Jacobin novel, poetic innovation, the Shelley circle, and travel literature.
Repeat Status: Course may be repeated.

ENGL 447 British Victorian Literature 3 Credits
The seminar will explore a focused topic in British Literature and Culture of the Victorian Age (1830-1901), including the Empire, taking into account larger historical, aesthetic, and theoretical concerns. Topics may include industry, imperialism, the cult of domesticity, aesthetics, the Woman Question, new sexual cultures, the Reform Acts, the emergence of photography and mass visual culture, the place of art and the artist, and modern nationalism.
Repeat Status: Course may be repeated.

ENGL 449 Special Topics in Modern British and Irish Literature 3 Credits
Topics in British and Irish literature before World War II. Topics may be organized by genre, theoretical mode of inquiry, or author. Topics might include: British Modernism; James Joyce and Modern Ireland; Virginia Woolf and Bloomsbury; East Meets West: British and Colonial Travel Writing; and Gender and Sexuality.
Repeat Status: Course may be repeated.

ENGL 452 Digital Humanities 3 Credits
Course will offer students an introduction to the concepts, techniques, and history of digital humanities scholarship. In addition to exploring the theoretical and methodological practices, we will look at how these practices can be used to interpret literary and cultural texts. Students will become conversant with key digital humanities methods and tools--from data-mining large textual corpora to curating archives of carefully edited texts--and will develop the critical thinking skills necessary to evaluate the success of digital scholarship.

ENGL 471 Early American Literature 3 Credits
This course explores topics in the literature of New England, the Middle Colonies, the South, the Southwest, and the Caribbean from Columbus to the close of the eighteenth century, emphasizing our cultural and artistic diversity. Titles may include The Literature of Justification, First Contact: Then and Now, America's Many Beginnings; and Literature of Revolution and the Early Republic.
Repeat Status: Course may be repeated.

ENGL 473 Antebellum American Literature 3 Credits
This course explores thematic topics in antebellum U.S. literature through readings in the expanded canon of American literature from approximately 1820-1865. Individual titles include: Class in Antebellum American Literature; Antebellum Literature and Transatlantic Reform; The Global Nineteenth Century; Print Culture and the Economics of Antebellum American Literature.
Repeat Status: Course may be repeated.

ENGL 475 Late Nineteenth-Century American Literature 3 Credits
This seminar will explore topics in American literature between the Civil War and the early twentieth century. Topics may be organized by genre, theoretical mode of inquiry, historical problematic, or interdisciplinary method. Topics might include, for example, Realism and Naturalism; Nineteenth-Century African American Literature and Politics.
Repeat Status: Course may be repeated.

ENGL 477 Modernism 3 Credits
This seminar will explore topics in literary modernism, including the formal innovations, political implications, historical configurations, and critical and theoretical approaches to the literatures of the early twentieth century. Topics may be organized around national literatures or trans-national formations. Topics might include Modernism and Mourning; Transatlantic Modernism; The Harlem Renaissance; Modernism and Social Justice.
Repeat Status: Course may be repeated.

ENGL 478 Contemporary American Literature 3 Credits
Topics in American literature since World War II. Lectures and class discussions of new writers and of recent works of established writers organized around various themes of import for the contemporary period.
Repeat Status: Course may be repeated.

ENGL 479 Contemporary World and Postcolonial Literature 3 Credits
Topics in contemporary world literature after 1960, engaging the history and legacy of European colonialism. Topics may be organized by genre, theoretical mode of inquiry, or interdisciplinary method. Topics might include: African Literature; South Asian Literature; Caribbean Literature; and Literature of Globalization.
Repeat Status: Course may be repeated.

ENGL 480 Composition and Rhetoric 3 Credits
This course explores a topic in composition studies or rhetoric. Topics may be historical, pedagogical, theoretical, or thematic.
Repeat Status: Course may be repeated.

ENGL 481 Theory and Criticism 3 Credits
Topics might include: Theories of Gender and Feminism; Theories of Transnationalism and Globalization; and Historicism.
Repeat Status: Course may be repeated.

ENGL 482 Theories of Literature and Social Justice 3 Credits
This course introduces students to theories of literature and social justice, addressing the following broad (and frequently overlapping) questions: What is social justice? How are literary forms (and literary criticism) distinctive in the ways in which they grapple with questions of social justice? How do literary forms reinforce or challenge dominant ideologies? In what ways does literature critique social injustice and imagine new models of more perfect human flourishing?

ENGL 483 Creative Writing and Literary Studies 3 Credits
From the Inside: Creative Writing and Reading. A combination of seminar and workshop, this course uses instruction and practice in the techniques and genres of creative writing (prosody, narratology, characterization, etc.) to develop tools for studying literary texts. Consent of instructor required.
Repeat Status: Course may be repeated.

ENGL 484 Teaching Composition II: A Practicum 1 Credit
Hands-on introduction to teaching research, argument, and multimodal composition at Lehigh. Usually rostered in the Spring semester to support the teaching of English 002. Required of all new teaching assistants in the department.

ENGL 485 Introduction to Writing Theory 2 Credits
Survey of major approaches and theoretical issues in the field of composition and rhetoric. Required of all new teaching assistants in the department. Usually rostered in conjunction with 400 or 486.

ENGL 486 Teaching Composition: A Practicum 1 Credit
Introduction to teaching writing at Lehigh. Bi-weekly discussions of practical issues and problems in the teaching of freshman composition. Required of all new teaching assistants in the department. Usually rostered in conjunction with English 485.

ENGL 487 Teaching with Technology: A Practicum 1 Credit
Hands-on introduction to the tools and skills necessary to teach with the computer, along with some attention to appropriate pedagogy. Consent of the graduate program coordinator required.

ENGL 488 Special Topics in Teaching Composition in College 1 Credit
A course that considers a pedagogical concept, instructional issue, special population, theoretical perspective, or mode of teaching that merits focused exploration. Sample topics include Teaching Developmental Writing in College, Teaching Writing to Students in Vocational Programs, Understanding Writing Assessment, Applied Rhetoric.
Repeat Status: Course may be repeated.

ENGL 489 Field Work or Research in the Teaching of Composition in College 1 Credit
A course that offers supervised field work or applied research projects for graduate students in the field of Composition and Rhetoric. These projects should include sustained investigation of the curricula, instructional methods, course materials, or pedagogical practices employed in college writing classes.
Repeat Status: Course may be repeated.

ENGL 490 Master's Thesis 3 Credits
Writing master's thesis papers.

ENGL 491 Special Topics 1-3 Credits
A topic, genre, or approach in literature or writing not covered in other courses. Consent of graduate program coordinator required.
Repeat Status: Course may be repeated.

ENGL 492 Introduction to Graduate Studies 1 Credit
This course will introduce students to the pragmatics of graduate school, from the research methods and tools that will inform the development of seminar papers to the expectations and values of our program and discipline.

ENGL 493 Graduate Seminar 3 Credits
Intensive study of the works of one or more authors, or of a type of literature.
Repeat Status: Course may be repeated.

ENGL 494 Rhetoric and Social Justice 3 Credits
An introduction to the theory and history of rhetoric, this course fosters deep exploration of the discipline of rhetoric's long standing engagement with the questions of justice, ethics, and responsibility.

ENGL 495 Independent Study 1-3 Credits
Individually supervised course in an area of literature, film or writing not covered in regularly listed courses. Consent of graduate program coordinator required.
Repeat Status: Course may be repeated.

ENGL 499 Dissertation 1-9 Credits
Research and study for comprehension exams.

Writing Courses

WRT 001 Academic and Analytical Writing 3 Credits
Introduction to academic writing, specifically analytical writing and essays that support claims in respectful conversation with other writers and thinkers. The course is centered on writing as a social process and provides focused instruction and ample practice in synthesis and analysis; collaboration and peer feedback; revision; and the conventions of college writing.

WRT 002 (ENGL 002) Research and Argument 3 Credits
Designed to refine the skills of argument and research. Students will make persuasive, thoughtful, and well-supported arguments in a variety of forms, including multimodal genres. The course provides a number of occasions to think, research, and write about pressing issues of public concern.

WRT 003 Composition and Literature I for Multilingual Writers 3 Credits
Students improve both their advanced academic written English and academic writing style through a process of reading fiction and non-fiction and by writing well-organized, coherent essays for academics. Author citation, style, and written fluency and accuracy are addressed within students' writing. Enrollment is limited to multilingual English speakers; prior academic writing history, English placement testing, and/or ICAPE director's recommendation determines placement.

WRT 005 Composition and Literature II for Multilingual Writers 3 Credits
Continuation of WRT 003. Students practice more advanced methods and modes of writing for academics, including writing and reading for their specific field of study. Students continue to work on advanced written fluency and accuracy of idiomatic language and expression and are taught advanced methods of author citation and source integration.

WRT 011 Advanced Writing:The Rhetorical Self 3 Credits
Rigorous engagement with rhetorical, stylistic, and design concepts vital to the creation of effective texts in traditional and multimodal formats. Student-driven projects allow for the development of voice and creativity in the presentation of self in academic, public, and personal contexts. The course culminates with a public-facing e-portfolio that showcases communication strengths and that can grow with students over the course of their education.

Environmental Initiative, Environmental Studies & Environmental Policy

Website: http://ei.cas.lehigh.edu/ **(**http://ei.cas2.lehigh.edu/**)**

Environmental Studies and the M.A. Program in Environmental Policy bring together faculty from the social sciences, natural sciences and humanities to deliver an interdisciplinary academic curriculum and promote environmental research and outreach. The curriculum includes courses from all five colleges and 10 departments in social sciences, humanities, education, science, mathematics and engineering. Students can earn an undergraduate BA degree in Environmental Studies, an undergraduate minor in Environmental Studies, and a graduate MA degree in Environmental Policy.

****The Environmental Studies subject code ES was recently changed to EVST. Those courses with subject code EVST are equivalent to the corresponding ES course. For example, the course EVST 002 fulfills the requirement for ES 002 in the Environmental Studies Program or any program listing ES 002 as a requirement.****

UNDERGRADUATE STUDIES

Website: http://ei.cas.lehigh.edu/ **(**http://ei.cas2.lehigh.edu/**)**

Students in the Environmental Studies Bachelor of Arts (BA) program examine complex environmental problems and solutions by combining social science, humanities and natural science perspectives, including the cultural, economic, historical, political and social factors that influence local, national, international and global environmental issues and policies. Environmental Studies students develop a broad understanding of environmental issues, as well as specialized skills and knowledge in one of three concentrations: Health; Policy, Planning and Law; or Politics and Society. Each concentration includes relevant skills courses and in-depth studies of environmental topics to help students prepare for careers.

The BA program prepares students for a variety of careers in fields such as environmental advocacy, environmental policy, urban planning, environmental health, environmental communication, environmental education, or environmental law. Careers can be found in federal, state and local government agencies, consulting companies, for-profit industries, nonprofit organizations, international non-governmental organizations, advocacy groups, online environmental communication sites and elsewhere. The program also prepares students for graduate studies in a number of environmental policy and social science fields including law.

The BA is designed to be broadly inclusive yet flexible enough to encourage double majors and minors in other fields. Double majors or minors in social science fields such as Anthropology; Sociology; Health, Medicine and Society; History; International Relations; Journalism; Political Science; or Psychology could easily be accomplished. Double majors or minors in the humanities in English; Art, Architecture and Design; Philosophy and Religion Studies can also be completed. The Environmental Studies BA degree complements existing BA and BS programs in Earth and Environmental Science. If students are not pursuing a double major, a minor in another field to complement the Environmental Studies major is highly recommended but not required.

The Environmental Studies BA is considered a social science major and most of its courses fulfill college social science distribution requirements.

****The Environmental Studies subject code ES was recently changed to EVST. Those courses with subject code EVST are equivalent to the corresponding ES course. For example, the course EVST 002 fulfills the requirement for ES 002 in the Environmental Studies Program or any program listing ES 002 as a requirement.****

Program Honors

To graduate with honors in the program, an Environmental Studies major must maintain a 3.2 overall grade point average, attain a 3.5 average in the courses constituting the major program, and complete an honors thesis in the senior year.

ENVIRONMENTAL STUDIES MAJOR

The Environmental Studies (EVST) major consists of four required courses (11 credits), two core courses (8 credits), and seven courses (24-28 credits) in a selected concentration. Students should select their preferred concentration preferably by their junior year. Two 300-level EVST courses are required. EVST majors are encouraged to double major or minor in another discipline that complements their concentration or the Environmental Studies program in general.

Required Courses		
EVST 001	Introduction to Environmental Studies	4
EVST/EES 002	Introduction to Environmental Science	3
EES 022	Exploring Earth: A Natural Science Laboratory Course	1
EES 023	Weather and Climate: Past, Present, and Future	3
or EES 024	Climate Change	
or EES 025	The Environment and Living Systems	
or EES 026	Energy – Origins, Impacts, and Options	
or EES 027	Natural Hazards: Impacts and Consequences	
or EES 028	Conservation and Biodiversity	
or EES 029	Human Health and the Environment	
or another science course approved by the faculty advisor.[1]		
Core Courses[2]		
Select two of the following:		8
EVST/POLS 105	US Environmental Policy and Law	
EVST/POLS 107	The Politics of the Environment	
EVST/POLS/HMS 110	Environmental Planning for Healthy Cities	
EVST/ANTH 121	Environment and Culture	
HIST/EVST 315	American Environmental History	
300-level courses		
Two EVST courses at the 300-level are required.		
Internships and Practicums		
Students are encouraged to participate in at least one practicum or internship experience. Faculty permission and direct supervision is required for EVST 393. Practicum course enrollments in EVST 294 must be approved for credit by the Program Director. A maximum of 8 internship or practicum credits can be counted toward the major as electives within concentrations.		
Suggested Math Courses		
MATH 012	Basic Statistics and Data Science	
or MATH 021	Calculus I	
Concentrations		**24-28**
There are four concentrations in the Environmental Studies major intended to serve a variety of different student interests and possible career choices. Each concentration has a skills, content, and elective sections. Preferably by their junior year, students will select one of the concentrations for their major program: 1) Health, 2) Policy, Planning & Law, or 3) Politics & Society. Many courses are found in more than one concentration, and while switching between concentrations is discouraged, it is possible if needed. In special cases, courses can be substituted within concentrations with the permission of the faculty advisor or program director. At least three EVST courses must be taken in a concentration and and at least one required content course in a concentration must be a 3-4 credit EVST course. Elective courses can be from the skills, content, or elective areas within a concentration.		
Total Credits		**43-47**

1 A science course taken as a required course cannot be used to fulfill a concentration requirement.

2 Selected core courses cannot be used to fulfill concentration requirements.

CONCENTRATION: HEALTH

The Health Concentration is geared toward students who are interested in learning about the interconnections between health and environmental impacts, particularly how environmental degradation can affect age groups, races and countries. It includes mitigation of environmental pollution and degradation, impacts on food resources, and the effects that natural and built environments have on people's mental and physical health.

Required Skills Courses (choose 2)		**6-8**
EVST/POLS 319	Mapping Data for Policymaking	4
EVST/TLT 367	Environmental Education	3
EVST/TLT 368	Teaching and Learning with Geospatial Tools	3
EVST/TLT 369	Applied Geospatial Tools	3
ANTH 214	How to Study Culture	4
CEE 272	Environmental Risk Assessment	2
CGH 106	Qualitative Methods in Health Research	3
CGH 375	Community Based Participatory Research Methodology	3-4
DOC/FILM 150	Introduction to Documentary Storymaking	4
SOC 211	Research Methods and Data Analysis	4
SOC 226	Computational Text Analysis	4
Required Content Courses (choose 2) [1]		**7-8**
EVST/HMS/POLS 110	Environmental Planning for Healthy Cities	4
EVST/HMS/POLS 320	Food Justice in Urban Environments	4
EVST 323	Health and Environmental Controversies	4
EVST/ANTH/GS 353	Ethnobotany: People and Plants	4
CGH 103	Biological & Environmental Determinants of Health	4
EES 029	Human Health and the Environment	3
HMS/PHIL/REL 116	Bioethics	4
POPH 001	Introduction to Population and Public Health	4
POPH 106	Global Environment and Human Welfare	3
Elective Courses (choose 3) [2]		**11-12**
EVST 170	Special Topics	1-4
EVST 127	Urban Permaculture	1-4
EVST 181	Independent Study	1-4
EVST 294	Practicum in Environmental Studies	1-4
EVST/ANTH 304	Socio-cultural Foundations of Environmental Policy	4
EVST 310	Foundations of Sustainable Development Practice	4
EVST/PSYC 357	Psychology of Environmental Issues	4
EVST/SOC/GS 370	Globalization and the Environment	4
EVST 371	Special Topics	1-4
EVST 391	Honors Thesis	1-4
EVST 393	Supervised Internship	1-4
ANTH 377	Archaeology Of Death	4
ECO 311	Environmental Economics	3
CGH 103	Biological & Environmental Determinants of Health	4
CGH 108	Food Justice	3
CGH 313	Health Policy and Politics	3
CGH 316	Global Environmental Disasters & Policy	3
CGH 375	Community Based Participatory Research Methodology	3-4
EES 027	Natural Hazards: Impacts and Consequences	3
ENGL/EVST 341	Contemporary US Literature of Environmental Crises	3-4
HMS/ENGL 115	Topics in Literature, Medicine, and Health	4
HMS/COMM 150	Health Communication	4
HMS/ENGL 315	Topics in Literature, Medicine, and Health	4
HMS/GS/SOC 322	Global Health Issues	4
POPH 106	Global Environment and Human Welfare	3

1

One course must be a 3-4 credit EVST course.

2

Can include any required skills or content courses not taken in another part of the concentration or the core courses.

CONCENTRATION: POLICY, PLANNING & LAW

The Policy, Planning and Law Concentration is geared toward students who are interested in learning about local, national and international regulations and programs designed to conserve the natural environment, to ensure that cities and neighborhoods are built in sustainable ways, and to protect vulnerable groups from bearing the brunt of environmental hazards.

Required Skills Courses (choose 2)		**6-8**
EVST/POLS 319	Mapping Data for Policymaking	4
EVST/TLT 367	Environmental Education	3
ANTH 214	How to Study Culture	4
CEE 272	Environmental Risk Assessment	2
CGH 106	Qualitative Methods in Health Research	3
CGH 375	Community Based Participatory Research Methodology	3-4
ECO 001	Principles of Economics	4
POLS 321	Research Methods	4
SOC 211	Research Methods and Data Analysis	4
SOC 226	Computational Text Analysis	4
Required Content Courses (choose 2) [1]		**7-8**
EVST 105	US Environmental Policy and Law	4
EVST/POLS 106	Environmental Values and Ethics	4
EVST/POLS 107	The Politics of the Environment	4
EVST/ANTH 304	Socio-cultural Foundations of Environmental Policy	4
EVST/POLS 312	Urban Environmental Policy Workshop	4
EVST/HIST 315	American Environmental History	4
EVST/POLS/HMS 320	Food Justice in Urban Environments	4
EVST/POLS 328	U.S. Politics and the Environment	4
ENGL/EVST 341	Contemporary US Literature of Environmental Crises	3-4
EVST/POLS 355	Environmental Justice: From Theory to Practice	4
EVST/POLS 366	Advanced Environmental Policy	4
EVST/SOC/GS 370	Globalization and the Environment	4
Elective Courses (choose 3) [2]		**11-12**
EVST/HMS/POLS 110	Environmental Planning for Healthy Cities	4
EVST/ANTH 121	Environment and Culture	4
EVST 127	Urban Permaculture	1-4
EVST 170	Special Topics	1-4
EVST 181	Independent Study	1-4
EVST 294	Practicum in Environmental Studies	1-4

EVST 305	Residential Segregation: Policies and Practices	4
EVST 310	Foundations of Sustainable Development Practice	4
EVST/POLS 311	Environmental Valuation for Policy Design	4
EVST/POLS 312	Urban Environmental Policy Workshop	4
EVST 323	Health and Environmental Controversies	4
EVST/POLS 328	U.S. Politics and the Environment	4
EVST/POLS 355	Environmental Justice: From Theory to Practice	4
EVST/PSYC 357	Psychology of Environmental Issues	4
EVST/TLT 368	Teaching and Learning with Geospatial Tools	3
EVST/SOC/GS 370	Globalization and the Environment	4
EVST 371	Special Topics	1-4
EVST 391	Honors Thesis	1-4
EVST 393	Supervised Internship	1-4
ANTH/GS 126	Urban Anthropology	4
CGH 103	Biological & Environmental Determinants of Health	4
CGH 316	Global Environmental Disasters & Policy	3
ECO 311	Environmental Economics	3
EES 023	Weather and Climate: Past, Present, and Future	3
EES 027	Natural Hazards: Impacts and Consequences	3
ENGL/EVST 341	Contemporary US Literature of Environmental Crises	3-4
POLS 115	Technology As Politics	4
POLS 103	Introduction to Public Administration	4
POLS 115	Technology As Politics	4
POLS 347	Constitutional Law and Politics	4
POLS 352	Civil Rights and Civil Liberties	4

[1]

One course must be a 3-4 credit EVST course.

[2]

Can include any required skills or content courses not taken in another part of the concentration or the core courses.

CONCENTRATION: POLITICS & SOCIETY

The Politics and Society Concentration is geared toward students who are interested in learning about how human-environment relationships are shaped by cultural practices, politics and broader social institutions, and how these cultural, political, and social factors might be changed to create more sustainable and socially just relationships.

Required Skills Courses (choose 2)		**6-8**
EVST 127	Urban Permaculture	1-4
EVST/PHIL 301	Philosophical-Policy & Legal Design: Methods & Applications	4
EVST/POLS 319	Mapping Data for Policymaking	4
EVST/TLT 367	Environmental Education	3
EVST/TLT 368	Teaching and Learning with Geospatial Tools	3
ANTH 214	How to Study Culture	4
ARCH/CEE 010	Engineering/Architectural Graphics and Design	3
CGH 375	Community Based Participatory Research Methodology	3-4
DOC/FILM 150	Introduction to Documentary Storymaking	4
ECO 001	Principles of Economics	4
ENGL 100	Working with Texts	4
POLS 321	Research Methods	4
SOC 211	Research Methods and Data Analysis	4
SOC 226	Computational Text Analysis	4
Required Content Courses (choose 2) [1]		**7-8**
EVST/POLS 105	US Environmental Policy and Law	4
EVST/POLS 106	Environmental Values and Ethics	4
EVST/POLS 107	The Politics of the Environment	4
EVST/PHIL/ETH 119	Environmental Ethics	4
EVST/ANTH 121	Environment and Culture	4
EVST/ASIA/REL 254	Buddhism and Ecology	4
EVST/ANTH 304	Socio-cultural Foundations of Environmental Policy	4
EVST/POLS 312	Urban Environmental Policy Workshop	4
EVST/HIST 315	American Environmental History	4
EVST/POLS/HMS 320	Food Justice in Urban Environments	4
EVST/POLS 328	U.S. Politics and the Environment	4
ENGL/EVST 341	Contemporary US Literature of Environmental Crises	3-4
EVST/POLS 355	Environmental Justice: From Theory to Practice	4
EVST/POLS 366	Advanced Environmental Policy	4
EVST/GS/SOC 370	Globalization and the Environment	4
Elective Courses (choose 3) [2]		**11-12**
EVST 170	Special Topics	1-4
EVST 181	Independent Study	1-4
EVST 127	Urban Permaculture	1-4
EVST 294	Practicum in Environmental Studies	1-4
EVST 305	Residential Segregation: Policies and Practices	4
EVST 310	Foundations of Sustainable Development Practice	4
EVST/POLS 312	Urban Environmental Policy Workshop	4
EVST/HMS/POLS 320	Food Justice in Urban Environments	4
EVST 323	Health and Environmental Controversies	4
EVST/ANTH/GS 353	Ethnobotany: People and Plants	4
EVST/PSYC 357	Psychology of Environmental Issues	4
EVST/SOC/GS 370	Globalization and the Environment	4
EVST 371	Special Topics	1-4
EVST 391	Honors Thesis	1-4
EVST 393	Supervised Internship	1-4
ANTH 377	Archaeology Of Death	4
CGH 316	Global Environmental Disasters & Policy	3
ECO 311	Environmental Economics	3
EES 029	Human Health and the Environment	3
ENGL 380	Contemporary American Literature	4
ENGL/EVST 341	Contemporary US Literature of Environmental Crises	3-4
GS 013	Religion and Food	4
HIST 008	Technology in Modern America	4
HIST/GS 101	Histories of Globalization	4
HIST/GS 107	Science and Technology in the Making of the Modern World	4
HMS/REL/PHIL 116	Bioethics	4
PHIL 128	Philosophy Of Science	4
POLS 115	Technology As Politics	4

POLS/AAS 230	Social Movements From the 1960s to Present	4
REL/GS 013	Religion and Food	4
SOC/AAS 313	Keep the Change: Social Movements in Society	4

[1]

One course must be a 3-4 credit EVST course.

[2]

Can include any required skills or content courses not taken in another part of the concentration or the core courses.

MINOR IN ENVIRONMENTAL STUDIES

A minor in Environmental Studies consists of four courses for a total of 15-16 credits.

EVST 001	Introduction to Environmental Studies	4
One additional course from the core set of courses for the major		3-4
Two additional EVST courses at the 100-level or above.		8
Total Credits		**15-16**

M.A. ENVIRONMENTAL POLICY

For more information visit Environmental Initiative

We are in a pivotal time for confronting environmental issues and studying the policies and tools necessary to create the communities and world we want to live in. The Master of Arts (MA) in Environmental Policy prepares students to act on the challenges presented by climate change, loss of biodiversity, urbanization, and agriculture. The program's interdisciplinary coursework covers the legal and political structures that do (or might) oversee, regulate, manage, subsidize, or otherwise affect environmental sustainability, environmental injustices, and environmental health. It also teaches about the social practices, moral authority and economic dynamics that affect interventions. Students gain deep insights and pragmatic skills through independent research and community-based projects and internships.

Applicants for the MAEP will be placed into one of three tracks (Thesis, Internship or Community Fellows).

Core Courses [1]		**9**
EVST/EES 402	Scientific Foundations for Environmental Policy Design	3
EVST 404	Socio-cultural Foundations of Environmental Policy	3
or EVST/POLS 466	Advanced Environmental Policy	
POLS 402	Methods Of Policy Analysis	3
or POLS 434	Quantitative Applications in Political Science	
or POLS 422	The Politics of Data	
Elective Courses		**15**
CEE 471	Environmental Risk Assessment	
CGH 316	Global Environmental Disasters & Policy	
ECO 303	Economic Development	
EES 318	Geographic Analysis in EES	
EES 325	Remote Sensing of Terrestrial and Aquatic Environments	
EVST/TLT 368	Teaching and Learning with Geospatial Tools	
EVST/POLS 405	Residential Segregation: Policies and Practices	
EVST 410	Foundations of Sustainable Development Practice	
EVST/POLS 411	Environmental Valuation for Policy Design	
EVST/POLS 412	Urban Environmental Policy Workshop	
EVST/POLS 419	Mapping Data for Policymaking	
EVST/POLS 420	Food Justice in Urban Environments	
EVST 453	Ethnobotany: People and Plants	
EVST/POLS 455	Environmental Justice: From Theory to Practice	
EVST/POLS 460	Public Administration	
EVST/POLS 466	Advanced Environmental Policy	
EES 446	Human-Climate Interactions	
POLS/ENTP 310	Social Entrepreneurship: How to Change the World	
POLS/GS/WGSS 342	Gender and Third World Development	
POLS 468	Political Economy	
POPH 317	Urban Greenspace and Health	
SOC/HMS 316	Social Epidemiology	
SOC/GS 319	The Political Economy of Globalization	
SOC/GS/HMS 322	Global Health Issues	
Tracks		**3-6**
Thesis track [2]		
EVST 490	Thesis	
Internship Track [3]		
EVST 480	Internship in Environmental Policy	
Community Fellows Track [4]		
A one year Master's Program in which students work for 15 hours a week in a non-profit organization as part of their academic experience. Please see the program website at www.lehigh.edu/communityfellows.		
POLS 464	Community Fellowship I	
POLS 465	Community Fellowship II	

[1]

Electives selected from approved list may include one additional course (up to a total of 6 credit hours) from the **Skills/Methods** category of required courses. Students are urged to select electives which allow for concentrated study in a particular area of academic interest.

[2]

Required courses (12 credits) + Elective courses (12-15 credits) + EVST 490 Thesis (3-6 credits) = Total 27-33 credits

[3]

Required courses (12 credits) + Elective courses (15 credits) + EVST 480 Internship in Environmental Policy (3-6 credits) = Total 30-33 credits

[4]

Required courses (12 credits) + Elective courses (12 credits) + POLS 464 Community Fellowship I (3 credits) + POLS 465 Community Fellowship II (3 credits) = 30 credits

CONCENTRATIONS WITHIN EP

The EP program provides students the opportunity to explore and focus on a variety of areas of academic and/or professional interest.

In the table below are examples of five possible concentrations that are especially suited to faculty expertise and program resources.

A total of 12-15 credits of electives comprise each concentration, plus a related internship experience or thesis topic. Students are also eligible to receive a "Graduate Certificate" in any of these concentration areas (see certificate program below).

Concentration in Environmental Policy and Planning

EVST/POLS 405	Residential Segregation: Policies and Practices
EVST/POLS 412	Urban Environmental Policy Workshop
EVST/POLS 455	Environmental Justice: From Theory to Practice
EVST/POLS 466	Advanced Environmental Policy
POLS 468	Political Economy

Concentration in Sustainable Development	
CGH 316	Global Environmental Disasters & Policy
ECO 303	Economic Development
EES 446	Human-Climate Interactions
ENTP/SDEV 307	International Social Entrepreneurship
EVST 410	Foundations of Sustainable Development Practice
EVST 453	Ethnobotany: People and Plants
POLS/GS/WGSS 342	Gender and Third World Development
SOC/GS 319	The Political Economy of Globalization
Concentration in Environmental Health	
EVST 453	Ethnobotany: People and Plants
EVST/POLS 455	Environmental Justice: From Theory to Practice
POLS 473	Globalization and Social Well-Being
SOC/GS/HMS 322	Global Health Issues
POPH 317	Urban Greenspace and Health
Concentration in Environmental Justice	
EVST/POLS 405	Residential Segregation: Policies and Practices
EVST/POLS 455	Environmental Justice: From Theory to Practice
POLS 230	Social Movements From the 1960s to Present
POLS 358	Interest Groups, Power, and Democracy in American Politics
POLS 473	Globalization and Social Well-Being

CONCENTRATIONS WITHIN EP

The EP program provides students the opportunity to explore and focus on a variety of areas of academic and/or professional interest.

In the table below are examples of five possible concentrations that are especially suited to faculty expertise and program resources.

A total of 12-15 credits of electives comprise each concentration, plus a related internship experience or thesis topic. Students are also eligible to receive a "Graduate Certificate" in any of these concentration areas (see certificate program below).

Concentration in Urban Environmental Policy and Planning	
EVST/POLS 405	Residential Segregation: Policies and Practices
EVST/POLS 412	Urban Environmental Policy Workshop
EVST/POLS 455	Environmental Justice: From Theory to Practice
POLS 348	Land Use, Growth Management, and the Politics of Sprawl
EVST/POLS 466	Advanced Environmental Policy
POLS 416	American Environmental Policy
Concentration in Environmental Law and Policy	
(Domestic and International)	
EVST/POLS 411	Environmental Valuation for Policy Design
EVST/POLS 455	Environmental Justice: From Theory to Practice
EVST/POLS 466	Advanced Environmental Policy
POLS 416	American Environmental Policy
POLS 468	Political Economy
Concentration in Sustainable Development	
ECO 303	Economic Development
EVST 410	Foundations of Sustainable Development Practice
EVST 453	Ethnobotany: People and Plants
POLS/ENTP 310	Social Entrepreneurship: How to Change the World
POLS/GS/WGSS 342	Gender and Third World Development
POLS 348	Land Use, Growth Management, and the Politics of Sprawl
SDEV/ENTP 307	International Social Entrepreneurship
SOC/GS 319	The Political Economy of Globalization
SOC/GS/HMS 322	Global Health Issues
EVST/POLS 419	Mapping Data for Policymaking
Concentration in Environmental Health	
EVST/HMS/JOUR 323	Health and Environmental Controversies
EVST/POLS 455	Environmental Justice: From Theory to Practice
POLS 473	Globalization and Social Well-Being
Concentration in Environmental Justice	
EVST/POLS 405	Residential Segregation: Policies and Practices
EVST/POLS 411	Environmental Valuation for Policy Design
EVST/POLS 455	Environmental Justice: From Theory to Practice
POLS/AAS 230	Social Movements From the 1960s to Present
POLS/ENTP 310	Social Entrepreneurship: How to Change the World
POLS 358	Interest Groups, Power, and Democracy in American Politics
POLS 416	American Environmental Policy
POLS 426	Organizing For Democracy
POLS 473	Globalization and Social Well-Being

GRADUATE CERTIFICATE PROGRAMS

Each graduate certificate requires a minimum of 12 credit hours (4 courses) from the list of EP core and elective courses specific to each area of study. A graduate of the EP program is only eligible to receive **ONE** of the following certificates. Certificate courses can be counted towards the master's, as appropriate, and must be completed in a maximum of 3 years.

ENVIRONMENTAL LAW AND POLICY

Core Course		**3**
EVST 401	Philosophical-Policy & Legal Design: Methods & Applications	
or EVST 404	Socio-cultural Foundations of Environmental Policy	
Elective Courses [1]		**9**
Select any three of the following:		
EVST/POLS 411	Environmental Valuation for Policy Design	
EVST 433	International Environmental Law & Philosophical-Policy Design	
EVST 442	International Law & Philosophical-Policy Design	
EVST 443	Comparative Environmental Law & Philosophical-Policy Design	
EVST/POLS 455	Environmental Justice: From Theory to Practice	
EVST/POLS 466	Advanced Environmental Policy	
EES 446	Human-Climate Interactions	
POLS 416	American Environmental Policy	
POLS 468	Political Economy	
Total Credits		**12**

[1]

Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300 level.

URBAN ENVIRONMENTAL POLICY AND PLANNING

Core Course		**3**
EVST 404	Socio-cultural Foundations of Environmental Policy	
or EVST/POLS 466	Advanced Environmental Policy	
Elective Courses [1]		**9**
EVST/POLS 405	Residential Segregation: Policies and Practices	
EVST/POLS 412	Urban Environmental Policy Workshop	
EVST/POLS 455	Environmental Justice: From Theory to Practice	
EES 446	Human-Climate Interactions	
POLS 468	Political Economy	
Total Credits		**12**

[1]

Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300 level.

ENVIRONMENTAL HEALTH

Core Courses		**3**
EVST 404	Socio-cultural Foundations of Environmental Policy	
or EVST/POLS 466	Advanced Environmental Policy	
Elective Courses [1]		**9**
EVST/POLS 420	Food Justice in Urban Environments	
EVST 453	Ethnobotany: People and Plants	
EVST 455	Environmental Justice: From Theory to Practice	
EES 446	Human-Climate Interactions	
POLS 473	Globalization and Social Well-Being	
POPH 317	Urban Greenspace and Health	
SOC/GS/HMS 322	Global Health Issues	
Total Credits		**12**

[1]

Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300 level.

ENVIRONMENTAL JUSTICE

Core Courses		**3**
EVST 455	Environmental Justice: From Theory to Practice	
Elective Courses [1]		**9**
POLS/AAS 230	Social Movements From the 1960s to Present	
POLS 358	Interest Groups, Power, and Democracy in American Politics	
EVST/POLS 405	Residential Segregation: Policies and Practices	
EES 446	Human-Climate Interactions	
POLS 349	Greed: Social Policy for Profit	
POLS 473	Globalization and Social Well-Being	
Total Credits		**12**

[1]

Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 200/300 level.

Courses

ES 110 (EVST 110, HMS 110, POLS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of "sustainability;" and grapple with the challenge of balancing communities' demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: SS

Courses

EVST 001 Introduction to Environmental Studies 4 Credits
This course surveys the dominant environmental issues confronting humanity and the natural world on a local, national, and global basis with an emphasis on critical thinking skills. Topics include humankind's role in environmental change; cultural perceptions and economic valuation of nature; resource availability and social equity; sustainability and consumerism; environmental justice and ethics; and environmental regulation, law, policy and planning. This course fulfills a social science credit requirement. Please select ES 002 to fulfill the natural science requirement.
Attribute/Distribution: CC, SS, SW, W

EVST 002 (EES 002) Introduction to Environmental Science 3 Credits
Focuses on natural and human-induced drivers and consequences of environmental change. Exploring options for mitigating and adapting to environmental change in ecosystems, physical and social systems, the course examines such topics as biogeochemical cycles, population pressure, ecosystem diversity, productivity and food security, energy, water resources, climate change, pollution, ozone, urban issues and sustainability. Stresses interactions using case studies. Intended for any student with an interest in the environment. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: CC, NS, NW

EVST 105 (POLS 105) US Environmental Policy and Law 4 Credits
Analysis of the framework that has been established to protect the environment and promote sustainable growth. Focus on the roles of the different branches of the U.S. government and the relative responsibilities of state and local governments within this framework. Consideration of the political nature of environmental issues and the social forces influencing environmental protection in different areas of domestic environmental policy, such as climate change, toxic waste disposal, and natural resources conservation.
Attribute/Distribution: CC, SS, SW, W

EVST 106 (POLS 106) Environmental Values and Ethics 4 Credits
An introduction to the ethical perspectives and values that shape human relationships to the natural environment in contemporary society. What are the moral implications of these relationships for justice and human collective action? Given these implications, what policy responses to environmental problems are morally or politically justifiable? In answering these questions, the course explores ethical ideas developed in different schools of environmental thought, such as deep ecology and ecofeminism, in addition to ideas that emerge from social movements, such as.
Attribute/Distribution: CC, HE, SS, W

EVST 107 (POLS 107) The Politics of the Environment 4 Credits
A survey of the major environmental, resource, energy and population problems of modern society, focusing on the United States. The politics of man's relationship with nature, the political problems of ecological scarcity and public goods, and the response of the American political system to environmental issues.
Attribute/Distribution: CC, SS, SW

EVST 110 (ES 110, HMS 110, POLS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of "sustainability;" and grapple with the challenge of balancing communities' demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: CC, SS, SW

EVST 119 (ETH 119, PHIL 119) Environmental Ethics 4 Credits
Evaluates the ethical and moral dimensions of humanity's relationship to nature as well as our individual and collective moral duties to confront urgent environmental challenges. Topics may include the intersection of climate and social justice; responsibilities to future generations, distant others, and nonhuman animals; the limitations of traditional ethical, political, and economic frameworks for accommodating our obligations and commitments to justice; and possible legal and public policy responses.
Attribute/Distribution: CC, HE, HU

EVST 121 (ANTH 121) Environment and Culture 4 Credits
Impact of environment upon cultural variability and change. Comparative study of modern and past cultures and their environments as well as current theories of human/ environmental interaction.
Attribute/Distribution: CC, SS, SW, W

EVST 125 (JOUR 125) Environment, the Public and the Mass Media 4 Credits
Extensive exploration of local, national and international environmental problems and their social, political and economic impacts. Analysis of mass media coverage of complex environmental issues and the media's effects on public opinion and government environmental policies. Examination of environmental journalism principles and practices in the United States and around the world.
Attribute/Distribution: CC, SS, SW

EVST 127 Urban Permaculture 1-4 Credits
Students combine social, political, economic, engineering, and ecological modes of thinking in the design, construction, and evaluation of permaculture food gardens to serve as living laboratories and interactive classrooms to teach about sustainable urban living. Open to students from any major and college. Instructor permission required.
Attribute/Distribution: CC, SS, SW

EVST 170 Special Topics 1-4 Credits
Intensive, research-oriented study of a subject or issue in Environmental Studies not covered in other courses. For students of demonstrated ability and adequate preparation. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

EVST 181 Independent Study 1-4 Credits
This course can be 1) directed readings on an environmental topic, 2) environmental research involving primary data collection and analysis, or 3) a project-based experience that puts students' understanding of environmental justice, environmental health, or environmental planning into practice. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

EVST 223 Advanced Sustainability in Action I 1-4 Credits
Leadership and coordination of Sustainability in Action projects and activities for students in EVST 123. Experienced students who have completed the year-long Sustainability in Action sequence (EVST 123 and EVST 124) continue in course coordination role. Offered in coordination with the Campus Eco-Reps Program. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: EVST 123 and EVST 124
Attribute/Distribution: CC

EVST 254 (ASIA 254, ETH 254, REL 254) Buddhism and Ecology 4 Credits
Buddhism's intellectual, ethical, and spiritual resources are re-examined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: CC, HE, HU, W

EVST 294 Practicum in Environmental Studies 1-4 Credits
Practical experience on or off campus in local, state or national environmental activities. Students must present a work plan that describes the activities included in the practicum, the activity's sponsor, expected outcomes and the number of credits requested. Must have program director's approval.
Repeat Status: Course may be repeated.
Prerequisites: ES 001 and ES 002 and (ES 105 or ES 107 or ES 110 or ES 121 or ES 125)
Can be taken Concurrently: ES 001, ES 002, ES 105, ES 107, ES 110, ES 121, ES 125
Attribute/Distribution: HU, NS, SS

EVST 296 1-4 Credits
Repeat Status: Course may be repeated.

EVST 301 (PHIL 301) Philosophical-Policy & Legal Design: Methods & Applications 4 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.
Attribute/Distribution: CC, W

EVST 304 (ANTH 304) Socio-cultural Foundations of Environmental Policy 4 Credits
This course is based on the premise that social and ecological sustainability require new policy approaches. Drawing on social, organizational, and behavioral theory, students will learn techniques for analyzing and critiquing existing environmental policies and designing more effective policies. Case studies highlight how cultural values, social norms, public opinion and politics shape policies and their outcomes. We examine the entire policy process from how environmental problems are defined, to how organizations implement policies and how policies are evaluated.
Attribute/Distribution: CC, SS, SW, W

EVST 305 (AAS 305, POLS 305) Residential Segregation: Policies and Practices 4 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.
Attribute/Distribution: CC, SS, SW

EVST 310 Foundations of Sustainable Development Practice 4 Credits
This course introduces students to the foundational themes of sustainable development, including food and nutritional security, social service delivery, energy policy, water resource management, urbanization, infrastructure, human rights, biodiversity, adaptation to climate change, greenhouse gas reductions, and sustainable business and governance. Students are mentored by Lehigh faculty as they engage with world leaders in sustainability through the Global Classroom, an instructional platform pioneered by Columbia University and the Global Masters of Development Practice Association (http://globalmdp.org/).
Attribute/Distribution: CC, SS, SW

EVST 311 (POLS 311) Environmental Valuation for Policy Design 4 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.
Attribute/Distribution: SS

EVST 312 (POLS 312) Urban Environmental Policy Workshop 4 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.
Attribute/Distribution: CC, SS, SW, W

EVST 315 (HIST 315) American Environmental History 4 Credits
Relationship between Americans and their natural environment from the colonial period to the present: impact of European settlement, attitudes toward wilderness, role of technological development, rise of preservation and conservation movements, establishment of national parks, recent environmental protection legislation.
Attribute/Distribution: CC, HE, SS

EVST 319 (POLS 319) Mapping Data for Policymaking 4 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers' attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).
Attribute/Distribution: Q, SS

EVST 320 (HMS 320, POLS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.
Attribute/Distribution: CC, SS

EVST 323 (HMS 323, JOUR 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.
Attribute/Distribution: SS, SW

EVST 328 (POLS 328) U.S. Politics and the Environment 4 Credits
An examination of contemporary American politics and policy dealing with environmental issues. Current controversies in the legislative and regulatory areas will be covered to examine environmental issues and the political process. Significant portions of the course readings will be taken from government publications.
Attribute/Distribution: SS

EVST 341 (ENGL 341) Contemporary US Literature of Environmental Crises 3-4 Credits
This course addresses how contemporary US literature depicts toxic America and the environmental crises as well as the human (and other animal) tragedies that result from a variety of contemporary practices that deny connectivity to/dependence upon ecosystems. Students will engage with some of the most important novels written in the contemporary period that call readers to address human impact on the environment, to imagine alternative & less ruinous ways of being in the world, and to imagine more sustainable futures.
Attribute/Distribution: CC, HE, HU, W

EVST 353 (ANTH 353, GS 353) Ethnobotany: People and Plants 4 Credits
This course explores the meanings and uses given to plants by diverse cultures in their unique ecological settings. Ethnobotany combines botany and cultural anthropology to study how people classify, use, and manage plants for medicine, food, and ritual. This course introduces the history, methods, theory, and practical applications of ethnobotany, including plant conservation, sustainable development, and cultural survival. Special emphasis will be placed on learning to do ethnobotany through student research projects.
Attribute/Distribution: CC, SS, SW, W

EVST 355 (POLS 355) Environmental Justice: From Theory to Practice 4 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administration policies, especially at the federal level. Considering the role of politics in the ongoing struggle for environmental justice, it reviews theories of substantive and procedural justice, and uses them to consider strategies for advancing equity in environmental law and policy.
Prerequisites: POLS 105 or ES 105
Attribute/Distribution: CC, SS

EVST 357 (PSYC 357) Psychology of Environmental Issues 4 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they perceive environmental risk and make decisions. We will also consider environmental communication and attitude and behavior change, exploring arenas ranging from patterns of consumption and recycling to climate change. Research methods for investigating these issues will be introduced.
Prerequisites: PSYC 001
Attribute/Distribution: CC, SS

EVST 366 (POLS 366) Advanced Environmental Policy 4 Credits
An introduction to the history of domestic environmental policy and contemporary policy trends, such as the rise of legal adversarialism and public participation in regulatory decisions. The role of market instruments in policy implementation, the emergence of rights-based approaches to environmental protection, and the role and value of distributional analysis will also be covered. Students will develop knowledge of a particular area of environmental policy at the federal, state, and/or level depending on their interests and current opportunities.
Prerequisites: POLS 105 or ES 105
Attribute/Distribution: CC, SS

EVST 367 (TLT 367) Environmental Education 3 Credits
Introductory environmental education course designed to prepare students to implement environmental education opportunities in formal and non-formal education settings. Topics include history and philosophy of environmental education, environmental laws and regulations, GIS, environmental issues and decision making, curriculum integration and environmental education teaching methodologies. This is a Web enhanced containing both online and fieldwork components.

EVST 368 (TLT 368) Teaching and Learning with Geospatial Tools 3 Credits
Exploration of geospatial tools, including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth). Application of these tools and techniques to instructional settings, including appropriate pedagogy and assessment. Not available for credit for students who have completed EVST/TLT 369.

EVST 369 (TLT 369) Applied Geospatial Tools 3 Credits
Introduction to geospatial tools--including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth)--and related concepts such as geo-databases, map projection, and remote sensing. Application of these tools and techniques to research, policy, business, public health, and communications. Not available to students who have taken EVST/TLT 368.

EVST 370 (GS 370, SOC 370) Globalization and the Environment 4 Credits
This course investigates how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes, focusing on the rapidly evolving global economic and political systems that characterize global development dynamics and resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution are key themes.
Attribute/Distribution: CC, SS, SW, W

EVST 371 Special Topics 1-4 Credits
Intensive, research-oriented study of a subject or issue in Environmental Studies not covered in other courses. For students of demonstrated ability and adequate preparation. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

EVST 391 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of students who apply and qualify for graduation with program honors. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

EVST 393 Supervised Internship 1-4 Credits
Experiential learning opportunities supervised by ES faculty including real-world experience with environmental organizations or governmental agencies, field work or research experience, all related to environmental studies. Students should collaborate with the supervising ES faculty member to develop a work plan that describes the activities included in the internship, the expected outcomes and the number of credits requested. Instructor permission required.
Repeat Status: Course may be repeated.
Prerequisites: ES 001 and ES 002 and (ES 105 or ES 107 or ES 110 or ES 121 or ES 125)
Attribute/Distribution: HU, NS, SS

EVST 401 Philosophical-Policy & Legal Design: Methods & Applications 3 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce the idea of Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.

EVST 402 (EES 402) Scientific Foundations for Environmental Policy Design 3 Credits
This course explores the science behind the environmental issues that bear on policy process at local, national and global scales. The course delves into the science of selected environmental issues that have either arisen from anthropogenic activities, that impact social systems, or that help policy-makers understand the consequence of different policy options. The course consists of readings and discussions of timely topics and one major project.

EVST 404 Socio-cultural Foundations of Environmental Policy 3 Credits
This course is based on the premise that social and ecological sustainability require new policy approaches. Drawing on social, organizational, and behavioral theory, students will learn techniques for analyzing and critiquing existing environmental policies and designing more effective policies. Case studies highlight how cultural values, social norms, public opinion and politics shape policies and their outcomes. We examine the entire policy process from how environmental problems are defined, to how organizations implement policies and how policies are evaluated.

EVST 405 (POLS 405) Residential Segregation: Policies and Practices 3 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

EVST 410 Foundations of Sustainable Development Practice 3 Credits
This course introduces students to the foundational themes of sustainable development, including food and nutritional security, social service delivery, energy policy, water resource management, urbanization, infrastructure, human rights, biodiversity, adaptation to climate change, greenhouse gas reductions, and sustainable business and governance. Students are mentored by Lehigh faculty as they engage with world leaders in sustainability through the Global Classroom, an instructional platform pioneered by Columbia University and the Global Masters of Development Practice Association (http://globalmdp.org/).

EVST 411 (POLS 411) Environmental Valuation for Policy Design 3 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.

EVST 412 (POLS 412) Urban Environmental Policy Workshop 3 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

EVST 419 (POLS 419) Mapping Data for Policymaking 3 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers' attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

EVST 420 (POLS 420) Food Justice in Urban Environments 3 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.

EVST 453 Ethnobotany: People and Plants 3 Credits
This course explores the meanings and uses given to plants by diverse cultures in their unique ecological settings. Ethnobotany combines botany and cultural anthropology to study how people classify, use, and manage plants for medicine, food, and ritual. This course introduces the history, methods, theory, and practical applications of ethnobotany, including plant conservation, sustainable development, and cultural survival. Special emphasis will be placed on learning to do ethnobotany through student research projects.

EVST 455 (POLS 455) Environmental Justice: From Theory to Practice 3 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administrative rule making at state and federal level. Reviewing the history of case law concerning environmental justice suits filed under the 1964 Civil Rights Act, it also examines the future of environmental justice in environmental law and policy.

EVST 457 (PSYC 457) Psychology of Environmental Issues 3 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they perceive environmental risk and make decisions. We will also consider environmental communication and attitude and behavior change, exploring arenas ranging from patterns of consumption and recycling to climate change. Research methods for investigating these issues will be introduced.

EVST 460 (POLS 460) Public Administration 3 Credits
The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary system; forms of administrative responsibility.

EVST 466 (POLS 466) Advanced Environmental Policy 3 Credits
An introduction to the history of domestic environmental policy and contemporary policy trends, such as the rise of legal adversarialism and public participation in regulatory decisions. The role of market instruments in policy implementation, the emergence of rights-based approaches to environmental protection, and the role and value of distributional analysis will also be covered. Students will develop knowledge of a particular area of environmental policy at the federal, state, and/or level depending on their interests and current opportunities.

EVST 470 Globalization and the Environment 3 Credits
This course investigates how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes, focusing on the rapidly evolving global economic and political systems that characterize global development dynamics and resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution are key themes.

EVST 480 Internship in Environmental Policy 3 Credits
Students will gain practical experience working with governmental or non-governmental organizations or public officials formulating and/or implementing environmental policies at local, regional, national or international levels. Requires submission of a formal proposal drafted in collaboration with a faculty advisor and the professional mentor who will oversee the student's internship. Upon completion of the internship, students will report project outcomes in oral presentation, written, or digital media format. Instructor permission required.
Repeat Status: Course may be repeated.

EVST 483 Independent Study 1-3 Credits
Independent Study.
Repeat Status: Course may be repeated.

EVST 490 Thesis 1-6 Credits
Thesis.

Ethics

Website:www.ethicscenter.cas.lehigh.edu **(**https://ethicscenter.cas2.lehigh.edu/**)**

The interdisciplinary academic Center for Ethics (http://catalog.lehigh.edu/graduatestudyandresearch/researchcentersandinstitutes/centerforethics/) promotes rigorous inquiry into, probing reflection on, and responsible engagement with the ethical dimensions of life from the personal to the global.

Ethics has to do with issues of action, character, and governing values, with questions about right and wrong, good and evil, worthiness and unworthiness, justice and injustice, with matters of individual and collective responsibility, respect and discrimination, war and peace, and with the norms, habits, and systems that make the persons we are, the lives we live, and the societies in which we live together, better or worse. Ultimately, ethics concerns how we ought to live, individually and collectively. Ethical concepts, issues, questions, norms, and systems can be studied philosophically, psychologically, sociologically, anthropologically, historically, politically; ethical inquiry engages the natural and applied sciences and engineering and addresses concerns in economics and business; ethical questions are explored in religion and literature and through artistic expression.

The Center's organizing perspective is that there is no aspect of human beings, no space in human lives, that does not have ethical dimensions—our intrapersonal lives, our interpersonal relations, as well as the educational, professional, familial, social, cultural, religious, artistic, political, economic, environmental, scientific, and global dimensions of our lives together. The ethics domain thus encompasses all aspects of Lehigh University.

For more information, visit our website. (https://ethicscenter.cas2.lehigh.edu/)

Emeriti. Robin S. Dillon, PhD (University of Pittsburgh)

ETHICS MINOR

The Ethics Minor is currently on hiatus until further notice.

The most important personal, professional, and social questions cannot be resolved through empirical research or technological innovation alone; they require disciplined engagement with the fundamental values at stake in private and public life. Lehigh's Minor in Ethics prepares students for this engagement, enabling them to think carefully and critically about a wide variety of controversial issues, from the use of military drones and self-driving cars to the protection of our environment and personal data; from issues of human well-being and justice (e.g. in healthcare, immigration, and the

economy) to the social problems of racism, sexism, and Islamophobia. The ethical knowledge and skills students develop in Lehigh's Minor in Ethics are personally enriching and directly contribute to good decision-making in professional and civic life.

The interdisciplinary Minor in Ethics requires a core course that provides students with a robust foundation and critical reasoning tools for identifying and addressing ethical issues and challenges. Elective courses enable students to apply the skills of ethical inquiry and reasoning to specific issues arising in a wide variety of areas and professional fields (e.g. legal, medical, business).

The minor in Ethics consists of 16 credits, including a core course and electives. At least one course must be at the 200-level or above. A maximum of 4 credits of independent study can count for the minor. Senior theses and honors and capstone courses or projects may be eligible. Each semester a complete list of courses eligible for the Ethics minor can be found on the Center for Ethics website (http://ethicscenter.cas2.lehigh.edu/) and students considering minoring in Ethics should consult with the Director of the Center for Ethics.

Courses

ETH 002 (HMS 002, REL 002) Death and Dying: Religious and Ethical Perspectives 4 Credits
Introduces students to the study of religion, world religious traditions and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.
Attribute/Distribution: HE, HU

ETH 003 (PHIL 003, REL 003) Global Religion, Global Ethics 4 Credits
Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally in and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, vengeance).
Attribute/Distribution: HE, HU

ETH 105 (PHIL 105) Ethics 4 Credits
Examination of right and wrong, good and bad, from classic sources such as Plato, Aristotle, Hume, Kant, Mill and Nietzsche.
Attribute/Distribution: CC, HE, HU, W

ETH 106 (HMS 106, PHIL 106, REL 106) Bioethics and the Law 4 Credits
Students in this course will learn something about the foundations and (nontechnical) workings of the American system of justice, and will combine that understanding with a focus on various topics in bioethics, from the "right to die" to gene-patenting. A key point will be the understanding that, as science and medicine continually move forward, there are always new challenges to existing legal understanding. How should the law respond to new questions, e.g. inheritance rights of posthumously conceived children?
Attribute/Distribution: HU

ETH 112 (PHIL 112) Business Ethics 4 Credits
This course will explore moral problems that arise in the production and distribution of goods and services. Topics may include: the intersection of government and business, stakeholder vs stockholder theory, moral obligations of employers and employees, discrimination in the workplace, theories of ownership, fraudulent practices, cons and scams, and ethics in sales. (HU).
Attribute/Distribution: CC, HE, HU

ETH 116 (HMS 116, PHIL 116, REL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: CC, HE, HU

ETH 119 (EVST 119, PHIL 119) Environmental Ethics 4 Credits
Evaluates the ethical and moral dimensions of humanity's relationship to nature as well as our individual and collective moral duties to confront urgent environmental challenges. Topics may include the intersection of climate and social justice; responsibilities to future generations, distant others, and nonhuman animals; the limitations of traditional ethical, political, and economic frameworks for accommodating our obligations and commitments to justice; and possible legal and public policy responses.
Attribute/Distribution: CC, HE, HU

ETH 120 (HMS 120, SOAN 120) Values and Ethics of Community-Engaged Research 4 Credits
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.
Attribute/Distribution: CC, SS, SW

ETH 149 (REL 149) Modern Islamic Ethics 4 Credits
This course will focus on developments in Islamic thinking and ethics that emerge from the modern encounter between Muslim societies and the West. We will discuss Islamic modernism and fundamentalism through short primary texts from a variety of modern Muslim thinkers.
Attribute/Distribution: CC, HE, HU, W

ETH 171 Independent Reading and Research 1-4 Credits
Independent study of selected topic designated and executed in close collaboration with a member of the Center for Ethics Program faculty. May be repeated for elective credit. Consent of program director required. Repeat status: May be repeated.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

ETH 191 Special Topics in Ethics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be crosslisted with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, SW, W

ETH 205 (PHIL 205) Ethics Seminar 4 Credits
Advanced seminar in Ethics. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

ETH 216 (HMS 216, PHIL 216, REL 216) Research Ethics 4 Credits
Research with human and animal subjects carries with it a host of ethical and legal obligations. Topics include the history of human subjects research; ethical use of placebo studies; the ethics of research in developing countries; whether there is an ethical obligation to volunteer to be a research subject.
Attribute/Distribution: HU

ETH 226 (HMS 226, REL 226) From Black Death to Covid-19:Plague,Pandemic,Ethics and Religion 4 Credits
An investigation into the ways religion and morality shape interpretations of plague and pandemics. Three specific pandemics are examined: the bubonic plague of the 14th century, the 1918 Spanish Flu pandemic, and the current global Covid-19 crisis. Moral issues provoked by institutional, political and social responses to pandemic disease are also considered.
Attribute/Distribution: HE, HU, W

ETH 254 (ASIA 254, EVST 254, REL 254) Buddhism and Ecology 4 Credits
Buddhism's intellectual, ethical, and spiritual resources are re-examined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: CC, HE, HU, W

ETH 271 Independent Reading and Research 1-4 Credits
Independent study of selected topics designated and executed in close collaboration with a member of the Center for Ethics Program faculty. May be repeated for elective credit. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

ETH 291 Special Topics in Ethics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be crosslisted with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

ETH 373 Internship 1-3 Credits
Supervised work in Center for Ethics allows students across the university to bring critical perspectives on ethical issues into the campus community. This course may be repeated for credit up to a maximum of 6 credits. Prerequisites: one course in ethics and consent of the Center director.
Repeat Status: Course may be repeated.

ETH 391 Special Topics in Ethics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be crosslisted with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

Film and Documentary Studies

Website:https://filmstudies.cas.lehigh.edu/ **(**https://filmstudies.cas2.lehigh.edu/**)**

Lehigh's Film and Documentary Studies Program offers interdisciplinary training in the diverse fields of visual culture, storytelling, and documentary studies. Students explore film traditions from various nations and historical eras, learn to interpret visual narratives, and produce their own filmic projects. Our course offerings help students learn to appreciate the complexities of communicating in different mediums. Faculty emphasize the importance of learning to convey effective messages visually, audibly, and through written texts, and the study of film helps us appreciate the power of synthesizing these mediums.

Film and Documentary Studies prepares students for careers in the film, television, and visual culture industries. Several of our students have also gone on to graduate study in film. Lehigh's students have enjoyed success in innovative film and television companies, and many of them have become active filmmakers, documentarians, or creative storytellers.

Film and Documentary Studies also readies individuals to convey stories and meanings in various ways. Our courses teach students to message visually as well as audibly, providing multiple avenues to reach potential audiences and clients. This training has become extremely valuable for today's careers in business, including jobs in advertising and marketing, where professionals must communicate to clients in diverse manners and with various tools.

Training in Film and Documentary Studies, moreover, prepares students to analyze numerous visual and audible scenarios, helping us to read our increasingly multimodal culture in our day-to-day lives. Our students become conscious of complex meanings within visual and auditory situations and stories, and this skill translates extremely well into careers in journalism, education, engineering, politics, and various health care professions.

The program includes two degree offerings: (1) a minor in Film Studies, and (2) an LVAIC minor in Documentary Storymaking.

As the different components of the program suggest, Film and Documentary Studies privileges both the critical study of film and visual culture as well as the practice of producing film and storymaking. We specifically encourage all our students to build professional portfolios of their filmic projects. Students from across the University enroll in our programs, benefiting from an interdisciplinary and international faculty.

FILM STUDIES MINOR

Lehigh's Film Studies minor offers students opportunities to think critically and creatively about film, television, and other forms of visual culture. Courses examine different film genres, movements, and national traditions, as well as recent television series that draw on the sophisticated visual and narrative strategies of cinema. Film Studies minors learn to appreciate and analyze the power and function of visual media. Students may take film production courses as their electives, giving them the opportunity to build a professional portfolio.

The minor in Film Studies consists of 15-16 credits of coursework and includes FILM 001 (Introduction to Film), a course on international, non-English-language film traditions, and two electives in the Film program. A maximum of 8 transfer credits, from other universities or through study abroad, is accepted toward the Film Studies minor. FILM 001 needs to be taken at Lehigh and will not transfer in from another university.

FILM 001	Introduction to Film	4
A course on international, non-English-language film traditions		4
Electives		7-8
Total Credits		**15-16**

Electives

FILM/ART 007	Digital Photography I	4
JOUR 012	Brown and White Videography	1
FILM/ART 052	Introduction to Video Recording and Editing	4
FILM/ENGL 066	The Slasher	4
FILM/MLL 100	Introduction to International Film	4
FILM/COMM/DOC/GS 102	The Sports Documentary	4
FILM/ART 107	Digital Photography II	4
FILM/ENGL 119	Introduction to the Horror Film	4
FILM/PHIL 120	Philosophy and Film	4
FILM/ENGL/WGSS 132	Viewing Mad Men: Window, Mirror, Screen	4
FILM/ENGL/WGSS 147	Made to Kill: Female Violence in Popular Film	4
FILM/ENGL/WGSS 149	Sexbots and Terminators: Cinematic Fantasies of the Intelligent Machine	4
FILM/DOC 150	Introduction to Documentary Storymaking	4
FILM/ENGL/WGSS 154	What Does Creativity Look Like? Documentary Visions	4
FILM/ENGL 162	How to Watch Movies Like a Hollywood Screenwriter	4
FILM/ENGL 163	Topics in Film Studies	4
FILM/HMS 166	Topics in Film and Health	4
FILM/LAS/SPAN 213	Introduction to Hispanic Literature and Film	4
FILM/MLL/GERM 231	New German Cinema	4
FILM/FREN 242	The Harem in French and Francophone Literature and Film	4
FILM/ART 247	Advanced Photography Workshop	4
FILM/DOC 250	Rights and Responsibilities in Documentary Inquiry	4
FILM/LAS/SPAN 265	Spanish and Latin American Cinema	4

FILM/MLL/WGSS/ ENGL 303	Grimms' Fairy Tales: Folklore, Feminism, Film	4
FILM/ANTH 311	African Culture on Film	4
FILM/ENGL 319	Advanced Studies in the Horror Film	3-4
FILM/FREN 322	Contemporary French Films	4
FILM/FREN 323	The Algerian War in Francophone Literature and Film	4
FILM/FREN 325	Illegal immigration in Francophone Literature and Film	4
FILM/DOC 370	Capstone in Documentary Storymaking	4
FILM/ENGL 387	Film History, Theory, and Criticism	3-4
FILM 391	Special Topics in Film	3,4
FILM 392	Film Internship	1-4
FILM 393	Film Independent Study	1-4

Electives

DOCUMENTARY STORYMAKING MINOR (LVAIC)

The Documentary Storymaking minor is a collaborative effort between Lehigh University, Lafayette College and Muhlenberg College, and is open to students pursuing any major across the University. The Documentary Storymaking minor offers students the opportunity to produce their own documentaries while learning about documentary research, ethics and practices. It emphasizes hands-on experience and engagement with the diverse communities of the Lehigh Valley. Students can take courses in documentary filmmaking offered by any of the participating institutions for credit towards the minor. For help with cross-registration through the LVAIC website, please visit: http:lvaic.org/for-students/cross-registration/ (https://lvaic.org/for-students/cross-registration/).

The LVAIC minor in Documentary Storymaking is a multicampus, multidisciplinary program that provides students an opportunity to integrate documentary making into their undergraduate studies. The study of documentary histories, theories, and practices is a way for students with diverse academic interests to develop digital literacies that complement the research and writing skills they are developing in their majors. It is designed to provide a foundation in the theory, ethics, and practice of documentary storymaking.

Courses in the minor provide students hands-on experience in documentary storymaking methods, tools and practices that will develop their capacity to communicate to broad audiences. While it develops students' individual capacities for creative and artistic expression, it is also deeply community-based and therefore connects students' learning to the issues, concerns, and stories of broader community life within the Lehigh Valley.

A minimum of five courses are required, including a sequence of three core courses and a minimum of two electives.

Core course sequence [1]		**12**
DOC/FILM 150	Introduction to Documentary Storymaking	
DOC/FILM 250	Rights and Responsibilities in Documentary Inquiry	
DOC/FILM 370	Capstone in Documentary Storymaking	
Electives (choose two) [2]		**6-8**
DOC/FILM/COMM/ GS 102	The Sports Documentary	
JOUR 024	Visual Communication	
JOUR 230	Multimedia Storytelling	
COM 231 Documentary Research (Muhlenberg)		
COM 344 Documentary Film & Social Justice (Muhlenberg)		
COM 389 Documentary Photography (Muhlenberg)		
COM 431 Documentary Field Work (Muhlenberg)		
FAMS 201: Making Media I (Lafayette)		
FAMS 202: Making Media II (Lafayette)		
FAMS 340: Documentary Film (Lafayette)		
Total Credits		**18-20**

1 Core courses are to be taken in sequential order.

2 Chosen in consultation with Program Adviser.

GRADUATE CERTIFICATE IN DOCUMENTARY FILM

The Graduate Certificate in Documentary Film is designed to augment students' education and provide practical experience for opportunities inside and outside the academy. This certificate program covers (1) the historical development and distinctive attributes of documentary film; (2) documentary planning, producing, and editing; and (3) ethical concerns surrounding documentary research and practice.

The program is open to graduate students in any department and has been especially useful for students in English, History, and Education. Students and faculty in the program collaborate with colleagues in the Center for Innovation in Teaching and Learning and the Digital Media Studio.

Completion of 12 credits, no more than 6 credits at the 300-level.

DOC 425	Theories and Methods of Documentary Process	3
DOC 433	Documentary Production Capstone	3
Two courses in consultation with Film and Documentary Studies Program Director; possible courses include:		6
HIST 305	Public History	
HIST 336	Bethlehem and the Lehigh Valley	
Total Credits		**12**

Documentary Storymaking Courses

DOC 091 Special Topics 1-4 Credits
A topic, genre, or approach in documentary studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SW, W

DOC 102 (COMM 102, FILM 102, GS 102, JOUR 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society's most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN's "30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.
Attribute/Distribution: HE, HU

DOC 104 (COMM 104, FILM 104) The Last Dance: Documentary Storymaking 4 Credits
This class explores documentary storytelling through an in-depth case study of the sports documentary "The Last Dance," the 10-part award-winning film series on basketball's Michael Jordan and the Chicago Bulls. Critical study of the making of "The Last Dance" reveals the numerous legal, ethical, creative, economic, technical, aesthetic and other considerations that go into the practice of documentary story making.
Attribute/Distribution: HE, HU

DOC 150 (FILM 150) Introduction to Documentary Storymaking 4 Credits
An introduction to digital documentary storymaking, merging critical study of documentary media with hands-on construction of documentary stories. Working with tools of the documentary arts—video, still images, audio, writing—students will acquire foundational skills of media production and effective storytelling while absorbing and analyzing rich examples of documentary storytelling over time and place. The course surveys traditions and issues in documentary media and introduces documentary practices and methods.
Attribute/Distribution: AL, HU

DOC 191 Special Topics 1-4 Credits
A topic, genre, or approach in documentary studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SW, W

DOC 250 (FILM 250) Rights and Responsibilities in Documentary Inquiry 4 Credits
This course explores the rights and responsibilities associated with documenting people, places, events, and situations. We will consider how documentary films construct and represent truth, the nature of documentarians' rights and responsibilities in relation to the communities, people, and collaborations, and how these issues inform other documentary practices. Topics discussed will include the impact of copyright law and fair use in documentary practice as well as ethical principles in relation to subjects, viewers and documentary filmmakers' own praxis.
Prerequisites: DOC 150 or FILM 150
Attribute/Distribution: AL, HU

DOC 291 Special Topics 1-4 Credits
A topic, genre, or approach in documentary studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

DOC 325 Theories and Methods of Documentary Process 4 Credits
This course examines the non-fiction representations of people, places and events. While the course content focuses on documentary film, we will also explore the genre through photographs, web-based documentary projects, and audio productions, including podcasts. Through assigned readings, audio, and the analysis of still and moving image, we will discuss the forms, strategies and conventions of documentary, investigate ethical and legal challenges, consider issues of representation, and gain an understanding of the historical significance and impact of the genre.
Attribute/Distribution: HU

DOC 370 (FILM 370) Capstone in Documentary Storymaking 4 Credits
Synthesizes course of study across the Documentary Storymaking Minor and solidifies learning in a collaborative documentary project. Course is required to complete Documentary Storymaking Minor. The Capstone is a workshop-based experience that guides students through the design, planning, field research, production, and completion of a substantial documentary media project that results in a public presentation of their most advanced work. Production will be informed and enhanced by class discussion of selected readings, screenings, relevant theories and practices in documentary.
Attribute/Distribution: CC, W

DOC 391 Special Topics in Documentary Studies 3-4 Credits
A topic, genre, or approach in documentary studies not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

DOC 392 Documentary Internship 1-4 Credits
Individualized work experience, on- or off-campus, in a field that a student of Film wishes to explore as a career. Before registering, a student must meet with the internship adviser and obtain departmental approval. Sophomore standing and departmental approval required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

DOC 393 Documentary Independent Study 1-4 Credits
Individually supervised study of a topic in documentary studies not covered in regularly listed courses. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

DOC 425 Theories and Methods of Documentary Process 3 Credits
This course examines the non-fiction representations of people, places and events. While the course content focuses on documentary film, we will also explore the genre through photographs, web-based documentary projects, and audio productions, including podcasts. Through assigned readings, audio, and the analysis of still and moving image, we will discuss the forms, strategies and conventions of documentary, investigate ethical and legal challenges, consider issues of representation, and gain an understanding of the historical significance and impact of the genre.

Film Studies Courses

FILM 001 Introduction to Film 0,4 Credits
Introduction to historical, technical, aesthetic, and cultural elements of film. We will consider issues of filmic production and film history and devote specific attention to different filmic techniques and critical approaches to mise-en- scène, cinematography, editing, and film sound. Students should develop a critical vocabulary for talking about film and various critical tools/strategies for analyzing film. Our primary goal is to enhance our enjoyment of film by learning to think about the filmic industry and its aesthetic productions more critically.
Attribute/Distribution: HE, HU

FILM 007 (ART 007) Digital Photography I 4 Credits
Intensive work in photography as fine art using digital input and output. Lectures, demonstratons, critiques.
Attribute/Distribution: AL, HU

FILM 052 (ART 052) Introduction to Video Recording and Editing 4 Credits
We will consider the interaction of image, sequence, motion, time and audio with video to create associative,abstract, documentary and narrative videos. Workshops in camera use, editing, concept development, lighting,sound and DVD authoring.
Attribute/Distribution: AL, HU

FILM 066 (ENGL 066) The Slasher 4 Credits
The slasher has been one of the most enduring subgenres of horror, evolving and continuing to thrive since 1978's Halloween. In this course, we will read some of the most important critical discussions of the slasher and watch films, from the 70s to the present, that embody both the core characteristics of the subgenre and its radical innovations. We will address what the slasher is, why it's remained so popular, and what ethical and political questions it raises.
Attribute/Distribution: HE, HU, W

FILM 091 Special Topics 1-4 Credits
A topic, genre, or approach in film not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SW, W

FILM 100 (MLL 100) Introduction to International Film 4 Credits
An introduction to international film traditions and theory. We look at the importance of cinema as both art and entertainment and consider the social, political, and economic role of film in national and global contexts.
Attribute/Distribution: HE, HU

FILM 102 (COMM 102, DOC 102, GS 102, JOUR 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society's most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN's "30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.
Attribute/Distribution: HE, HU

FILM 104 (COMM 104, DOC 104) The Last Dance: Documentary Storymaking 4 Credits
This class explores documentary storytelling through an in-depth case study of the sports documentary "The Last Dance," the 10-part award-winning film series on basketball's Michael Jordan and the Chicago Bulls. Critical study of the making of "The Last Dance" reveals the numerous legal, ethical, creative, economic, technical, aesthetic and other considerations that go into the practice of documentary story making.
Attribute/Distribution: HE, HU

FILM 107 (ART 107) Digital Photography II 4 Credits
An opportunity to produce a unified body of work and to explore digital photography on a deeper level with an opportunity to produce a unified body of work and to explore digital photography on a deeper level with an emphasis on conceptually driven images. Experimental process encouraged.
Prerequisites: ART 007 or FILM 007
Attribute/Distribution: HU

FILM 119 (ENGL 119) Introduction to the Horror Film 4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self-reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called torture porn" to the return of the "possession" film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

FILM 120 (PHIL 120) Philosophy and Film 4 Credits
This seminar course will explore a variety of themes, genres, and movements within cinema from a philosophical perspective. Regular screenings of films from silent era to present. Content may vary depending upon instructor.
Attribute/Distribution: CC, HE, HU, W

FILM 132 (ENGL 132, WGSS 132) Viewing Mad Men: Window, Mirror, Screen 4 Credits
Widely considered one of the best TV shows ever made, Mad Men demonstrated that television serial drama could combine virtuoso storytelling, cinematic visual style and historical ambition. Set in a New York ad agency in the 1960s, Mad Men both opens a window onto the past and holds a mirror up to the present. We will analyze Mad Men’s innovative visual and narrative style and explore two core themes: shifting gender roles and the influence of advertising in U.S. society.
Attribute/Distribution: HE, HU

FILM 147 (ENGL 147, WGSS 147) Made to Kill: Female Violence in Popular Film 4 Credits
Heroes. Monsters. Outlaws. Catsuits. In the wake of the second-wave feminist movement, U.S. films in the horror, thriller, and action/adventure genres began to represent women as perpetrators of violence more frequently and in new ways. This course examines how iconic films from the last four decades, such as The Silence of the Lambs, Alien, The Hunger Games and Wonder Woman, have both reflected and shaped the ongoing cultural debate about gender, sexuality and power.
Attribute/Distribution: HE, HU

FILM 149 (ENGL 149, WGSS 149) Sexbots and Terminators: Cinematic Fantasies of the Intelligent Machine 4 Credits
For decades, film and television narratives have represented human relationships with robots to explore existential issues in human life: love, sex, mortality, labor, domination, exploitation. Could robots solve the difficulties of human intimacy? Could artificial intelligence enable us to cheat death? What do sex robots reveal about misogyny? Why are human/AI relationships so frequently imagined in Western narratives as master/slave relationships? Films and TV shows may include The Matrix, Ex Machina, Her, Terminator 2, Black Mirror and Westworld.
Attribute/Distribution: HE, HU, W

FILM 150 (DOC 150) Introduction to Documentary Storymaking 4 Credits
An introduction to digital documentary storymaking, merging critical study of documentary media with hands-on construction of documentary stories. Working with tools of the documentary arts—video, still images, audio, writing—students will acquire foundational skills of media production and effective storytelling while absorbing and analyzing rich examples of documentary storytelling over time and place. The course surveys traditions and issues in documentary media and introduces documentary practices and methods.
Attribute/Distribution: AL, HU

FILM 151 (ENGL 151, GS 151) Global Cinema 4 Credits
This course introduces students to contemporary filmmakers from Asia and Africa who have been inspired by globalization, dealing with issues such as mass migration, ethnic conflict and civil war, transnational finance and technology, and ongoing social and economic inequities. The course will be divided into four geographical units, with a representative mix of art films, popular genres (Bollywood and Nollywood), and global science fiction and horror. Filmmakers may include Mira Nair, Farah Akhtar, Bong Joon-ho, and Asghar Farhadi, among others.
Attribute/Distribution: CC, HE, HU, W

FILM 154 (ENGL 154, WGSS 154) What Does Creativity Look Like? Documentary Visions 4 Credits
What can documentary films tell us about creativity? What is it and why does it matter? This course takes an intersectional approach to creativity, centering the role of gender, sexuality, race and class in the lives and work of the artists and activists represented in the course films. We will also analyze the creative visual and narrative strategies these documentaries employ to shape the stories they tell. Students will have an opportunity to document the creativity of their own communities.
Attribute/Distribution: HE, HU

FILM 162 (ENGL 162) How to Watch Movies Like a Hollywood Screenwriter 4 Credits
A course about screenplays: their history, their role in the film industry, and the books that promise to teach screenwriters the tricks of the trade. After reading excerpts from the most influential screenwriting books of the last 40 years, students will be able to identify the “Hollywood Model” of screenplay conventions regarding character, plot structure, and genre. They will also learn how to write critically about how these conventions have shaped assumptions about race, gender, and international audiences.
Attribute/Distribution: HE, HU, W

FILM 163 (ENGL 163) Topics in Film Studies 4 Credits
History and aesthetics of narrative film. May be repeated for credit as subject varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

FILM 166 (HMS 166) Topics in Film and Health 4 Credits
This course will involve extended study in a sub-area of Film with a focus on health, medicine, and/or illness.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

FILM 191 Special Topics 1-4 Credits
A topic, genre, or approach in film not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SW, W

FILM 213 (LAS 213, SPAN 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

FILM 231 (GERM 231, MLL 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films.
Attribute/Distribution: CC, HE, HU, W

FILM 242 The Harem in French and Francophone Literature and Film 4 Credits
Explore representations of this forbidden and secret feminine space, the harem, starting with French theater from the 17th century all the way to 20th-21st century Francophone North African novels and film. We will attempt a comparative study between the French and Francophone traditions and will be looking at the harem as a visual as well as textual feminine space from which narratives emerge and the extent to which they constitute a counter-discourse that questions dominant power structures.
Attribute/Distribution: HU

FILM 247 (ART 247) Advanced Photography Workshop 4 Credits
Building on skills and concepts developed in Photography I and II, students will further their exploration of lens-based media and photo-based materials and processes, and the development of visual language in a structured environment. Through rigorous critique students develop their own voice, style and practice, building advanced digital and print bodies of work for professional review. Prerequisite: Art 107.
Prerequisites: ART 107 or FILM 107
Attribute/Distribution: HU

FILM 250 (DOC 250) Rights and Responsibilities in Documentary Inquiry 4 Credits
This course explores the rights and responsibilities associated with documenting people, places, events, and situations. We will consider how documentary films construct and represent truth, the nature of documentarians' rights and responsibilities in relation to the communities, people, and collaborations, and how these issues inform other documentary practices. Topics discussed will include the impact of copyright law and fair use in documentary practice as well as ethical principles in relation to subjects, viewers and documentary filmmakers' own praxis.
Prerequisites: FILM 150 or DOC 150
Attribute/Distribution: AL, HU

FILM 265 (LAS 265, SPAN 265) Spanish and Latin American Cinema 4 Credits
An introduction to cinema in the Spanish-speaking world. Oral discussion and written analysis of selected films. Students view films independently.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

FILM 291 Special Topics 1-4 Credits
A topic, genre, or approach in film not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FILM 303 (ENGL 303, GERM 303, MLL 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: CC, HE, HU, W

FILM 311 (AAS 311, ANTH 311) African Culture on Film 4 Credits
Cinematic representations of Africans and their culture are nearly as old as cinema itself.This course surveys films depicting African peoples, some made by outsiders but mostly by Africans themselves, to explore questions about culture, identity, race, and power. From ethnographic filmmakers like Jean Rouch and pioneers like Ousmane Sembene through today's flourishing Nollywood industry, cinematic depictions of life on the African continent have changed the way the world sees Africans and their place in the world.
Attribute/Distribution: HU, SS

FILM 319 (ENGL 319) Advanced Studies in the Horror Film 3-4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called "torture porn" to the return of the "possession" film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

FILM 322 (FREN 322) Contemporary French Films 4 Credits
French Films from the late 1950s to the present. Introduction to cinematograhic language and exploration of the issues of gender, power, and madness. Films by Truffaut, J-L Godard, C. Denis, A. Varda, J-J Beineix, E. Rohmer, and others.
Attribute/Distribution: HU, W

FILM 323 (FREN 323) The Algerian War in Francophone Literature and Film 4 Credits
This course deals with representations of the Algerian War and its consequences in francophone works by postcolonial authors and filmmakers from France and Algeria. We will examine the historical context of the conflict, issues of torture, repressed memories and trauma, nation-building narratives, the meaning of independence, the role of women and the complexities of postcolonial identity formation as experienced by Algerians and the Algerian Diaspora in France. Taught in French.
Attribute/Distribution: HU, W

FILM 325 (FREN 325) Illegal immigration in Francophone Literature and Film 4 Credits
This course examines representations of illegal immigrants in postcolonial francophone literature and film. We will be looking at visual and textual narratives from and about those who decided to leave their African homeland to seek a better future in Europe despite the very restrictive policies adopted by most of the European Union on illegal immigration. The course will explore issues of postcolonial identity, the notions of borders, displacement, exile, trauma and how they relate to the act of writing.
Attribute/Distribution: HU, W

FILM 370 (DOC 370) Capstone in Documentary Storymaking 4 Credits
Synthesizes course of study across the Documentary Storymaking Minor and solidifies learning in a collaborative documentary project. Course is required to complete Documentary Storymaking Minor. The Capstone is a workshop-based experience that guides students through the design, planning, field research, production, and completion of a substantial documentary media project that results in a public presentation of their most advanced work. Production will be informed and enhanced by class discussion of selected readings, screenings, relevant theories and practices in documentary.
Attribute/Distribution: CC, W

FILM 387 (ENGL 387) Film History, Theory, and Criticism 3-4 Credits
Study of film with the focus on particular genres, directors, theories, periods, or topics. Weekly film screenings. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

FILM 388 (SPAN 388) The (Un)Translatable Spaces of Contemporary Spain 4 Credits
This seminar delves into the act of translation both as a nexus of comprehension between languages and cultures but also as a medium of signification of habits and ways of life in times of globalization. Concentrating specifically on contemporary Spain impacted by technological growth and economic stagnation, our seminar will examine works of art, literature, film, and poetry that bring to light the power of translation as well as its limits in the circulation of languages, customs, politics and cultures.
Repeat Status: Course may be repeated.
Prerequisites: SPAN 151
Attribute/Distribution: CC, HU, W

FILM 391 Special Topics in Film 3,4 Credits
A topic, genre, or approach in film not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

FILM 392 Film Internship 1-4 Credits
Individualized work experience, on- or off-campus, in a field that a student of Film wishes to explore as a career. Before registering, a student must meet with the internship adviser and obtain departmental approval. Sophomore standing and departmental approval required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

FILM 393 Film Independent Study 1-4 Credits
Individually supervised study of a topic in film not covered in regularly listed courses. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

Global Studies

Website: http://global.cas.lehigh.edu/ **(**http://global.cas2.lehigh.edu/**)**

Global Studies (GS) is an interdisciplinary program in the College of Arts and Sciences that explores the uneven local, regional and global ramifications of the economic, social, political and cultural processes of globalization. Global Studies offers the GS major, a GS minor, and a joint degree in GS/MLL for students who want to integrate advanced language and culture studies.

The mission of the Global Studies program is to provide students with an interdisciplinary understanding of globalization and contemporary issues, including global inequality. Moving away from conventional state-centered notions of international exchange, the Global Studies program aims to decolonize and decenter discourses on global development and recognizes that globalization's costs and benefits have not been equitably distributed.

Global Studies seeks to illuminate the underlying causes of grand challenges, such as those related to inclusive development, human well-being, and sustainability. Global Studies aims to promote recognition of the relevance of states, international financial institutions, NGOs, as well as the local and regional contexts that shape the unique cultural identities of both individuals and communities. Within a multi-disciplinary framework, the interplay of these factors reveals the uneven outcomes of globalization while also creating potential agents for social change.

The Global Studies program encourages the study of diverse languages and cultures. We aim to create students and scholars who are forward thinkers, able to work with people from diverse backgrounds, and capable of thinking critically about topics from multiple perspectives.

The Global Studies program promotes international opportunities for students, especially those that require longer or more intensive immersion in a particular place or culture. Through these international and cross-cultural experiences, rigorous classroom collaborations, and engaging faculty and student connections in areas of research and experiential learning, the Global Studies program prepares students to be critically engaged citizens of their local, national and global communities.

GLOBAL STUDIES MAJOR
The BA in Global Studies requires a total of 36-40 credits, the structure is outlined below.

Introductory Course [1]		**4**
GS 001	Introduction to Global Studies	
Core Courses		**14-16**
Select one course from each core area that explores how globalization shapes and is shaped by social, cultural, historical, and political factors. [2]		
Arts and Humanities Core		
GS/MLL 070	Other Voices: Being Human around the Globe	
or GS/REL 140	Globalization and Religion	
or GS/ENGL/FILM 151	Global Cinema	
History Core		
GS/HIST 101	Histories of Globalization	
Culture Core		
ANTH 011	Cultural Diversity and Human Nature	
GS/ANTH 106	Cultural Studies and Globalization	
Politics Core		
IR 010	Introduction to World Politics	
GS/POLS 003	Comparative Politics	
GS/POLS/PHIL 100	Introduction to Political Thought	
Elective Coursework		**14-16**
Select four elective courses (see list below). [1,2,3]		
Capstone Course		**4**
GS 319	The Political Economy of Globalization (Writing Intensive)	
Collateral Requirements		
Language Requirement		
Global Studies majors are required to complete the equivalent of 4 semesters of language study in a language or languages other than English. Some students place out of a language course or courses through one of the mechanisms listed below; thus, students might meet the Global Studies major language requirement by taking anywhere from 0-16 credits of language study. Students may fulfill or work towards fulfilling the GS language requirement in a number of ways, including by:		
-Taking language courses at Lehigh at any level. (This could be all in one language, or across two different languages; studying three different languages is also permitted but should be pursued only in special circumstances.)		
- Taking a language course or courses while studying abroad.		
- Minoring in a language through the Department of Modern Languages and Literatures.		
- Transferring in credit from language courses taken at other institutions.		
- Placing out of a language course or set of courses through AP transfer credit or through formal assessment with a Lehigh language professor.		
- By demonstrating written and oral fluency in a language other than English.		
Study Abroad or International Internship		

	Students should complete 12 credits of study abroad, which can be used to fulfill elective or core course requirements when appropriate. Students may also substitute an international internship for study abroad; the internship must include a minimum of 100 hours over at least six weeks (presumably during the summer) and must be at an organization connected to global issues. If extended time abroad is a hardship, GS students may also petition the program director to undertake a U.S.-based internship directly involved in international and global issues.
Total Credits	**36-40**

1

GCP 010 Intro to Global Citizenship may be substituted for GS 001 Intro to Global Studies for all declared GS majors.

2

These courses may be taken during study abroad experience with permission of the program director.

3

At least two electives must be 200-level or above.

ELECTIVES

GCP 010	Introduction to Global Citizenship	3
GS/REL 011	Introduction to World Religions	4
GS/REL 013	Religion and Food	4
GS/HIST 015	Three English Revolutions	4
GS/HIST 017	Democracy's Rise and Fall	4
GS/REL 044	Religious Fundamentalism in Global Perspective	4
GS/LAS/HIST 049	The True Road to El Dorado: Colonial Latin America	4
GS/LAS/HIST 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence	4
GS/REL/ASIA 077	The Islamic Tradition	4
GS/COMM/DOC/FILM/JOUR 102	The Sports Documentary	4
GS/HIST 107	Science and Technology in the Making of the Modern World	4
GS/ANTH 108	Not-so-Lonely Planet: The Anthropology of Tourism	4
GS/ANTH/LAS 117	Archaeology of Latin America	4
GS/AAS/ART 124	Arts of the Black World 16th-20th Centuries	4
GS/AAS/ART 125	Art and Architecture of Africa from Colonial to Contemporary Times	4
ANTH/GS 126	Urban Anthropology	4
GS/POLS 127	The Politics of Ending Global Poverty	4
GS/MLL 129	The Global Workplace: Preparing to Work around the World	4
GS/WGSS/HIST/AAS 131	Women, Gender, Sexuality and Race in African Societies	4
GS/REL 140	Globalization and Religion	4
GS/REL 143	Religious Nationalism in a Global Perspective	4
GS/ASIA/REL 145	Islam and the Modern World	4
GS/REL 148	Islam Across Cultures	4
GS/HMS/ANTH 155	Medical Anthropology	4
GS/JST/REL 161	Globalization in the Ancient Mediterranean	4
GS/HMS/SOC 162	HIV/AIDS and Society	4
GS/ANTH 173	Archaeology of the Middle East	4
GS/HIST/REL/JST 175	History of Racism, anti-Semitism, and Islamophobia	4
GS/HMS/AAS/HIST 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness	4
GS/AAS/HIST 178	Globalization and Health in Ghana	3
GS/ART/HIST 183	France from Medieval to Modern:Soc., Pol. & Art	3
GS/HIST/ARCH 184	Paris: The Global City	3
ANTH/GS/ASIA 187	Contemporary Southeast Asia	4
GS/ASIA/POLS 201	South Asian Politics	4
GS/ENGL/MLL/LAS 202	Latin America In Fact, In Fiction	4
GS/ART 221	Global Contemporary Art	4
GS/JOUR 246	International Communication	4
GS/ASIA/REL 247	Islamic Mysticism	4
GS/FREN 259	Contemporary France	3-4
GS/ENGL/LAS/MLL 302	Travel and Adventure in Latin American Fiction	4
GS/AAS/HMS/SOC 314	Infections and Inequalities: HIV, TB and Malaria in the Global South	4
GS/ENGL 316	Native American Literature	4
GS/ANTH/AAS 317	So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development	4
GS 320	Global Capitalism	4
MKT 320	Global Marketing	3
GS/HMS/SOC 322	Global Health Issues	4
GS/POLS 325	Nationalism, Regionalism, and Populism	3,4
GS/SOC 328	Global Food Systems	4
GS/SOC/WGSS 331	Gendered Experience of Globalization	4
GS/ASIA/POLS 339	The Rise of the State in Modern East Asia	4
GS/AAS/HIST 341	Global Africa: Aid, Volunteerism, NGO's and International Studies	3,4
GS/POLS/WGSS 342	Gender and Third World Development	3-4
GS/AAS/ASIA/POLS 343	Global Politics of Race: Asia and Africa	4
GS/MGT 346	International Business	3
GS/HIST 347	The French Revolution and Napoleon: A Global History	3,4
GS/HIST 348	The British Empire and the Modern World	3-4
GS/ANTH/EVST 353	Ethnobotany: People and Plants	4
GS/ANTH 366	Power, Preparedness, Precarity: Urban Resilience in an Age of Uncertainty	4
GS/POLS/WGSS/ASIA 369	Women's Movement in China	4
GS/EVST/SOC 370	Globalization and the Environment	4
GS 390	Readings in Global Studies	1-4
GS 391	Special Topics	1-4
GS 392	Internship in Global Studies	1-4
GS 394	Senior Thesis	1-4
GS 399	Directed Research in Global Studies	1-4

Electives

1

GCP 010 may also be substituted for GS 001 Intro to Global Studies for all declared GS majors.

DEPARTMENTAL HONORS

While all GS students are encouraged to pursue research opportunities and complete a senior thesis, in order to receive departmental honors, Global Studies majors must earn a 3.5 major GPA, take GS 394 Senior Thesis, and receive an A grade on their thesis.

GLOBAL STUDIES MINOR

A minor in Global Studies consists of four courses with at least one core course and at least one class at the 200 level or above. Visits to the UN as well as study abroad or Lehigh Abroad are strongly recommended.

GS 001	Introduction to Global Studies	4
Select one course from the list of core courses.		4
Select two courses from the list of elective courses. [1, 2, 3]		7-8
Total Credits		**15-16**

1

One class must be 200 level or above.

2

Core courses may substitute for elective courses.

3

With the approval of the program director, Global Studies minors may identify other courses not included on the elective list to satisfy the elective requirement including those taken as during study abroad.

Courses

GS 001 Introduction to Global Studies 4 Credits
Globalization - the historical and continuing integration of peoples, cultures, markets and nations - is the defining characteristic of our century. It brings with it advantages and disadvantages, surfeit and suffering. In this interdisciplinary course, the foundation of the Global Studies major, students will be introduced to a variety of historical, critical and analytical perspectives, methods and vocabularies for continued study of globalization and social change. Priority given to CAS freshmen and sophomores.
Attribute/Distribution: CC, SS, SW

GS 003 (POLS 003) Comparative Politics 4 Credits
The political systems of foreign countries; approaches to the study of comparative politics.
Attribute/Distribution: CC, SS, SW

GS 011 (REL 011) Introduction to World Religions 4 Credits
Living and working in a globalizing 21st century requires an understanding of diverse religious and cultural identities. In this course, students will be introduced to the history, ideas, and practices from a wide variety of the world's religious traditions.
Attribute/Distribution: HE, HU

GS 013 (REL 013) Religion and Food 4 Credits
This course explores the complex connections between religion and food. We will examine food-related rituals, including Jewish Passover seders, Christian communion, and Hindu puja; the role of gastronomy in forming religious and ethnic identity; and the global ethics of food and sustainability. We will also probe the notion of food itself as sacred. Are “foodies” engaging in their own sort of sacred actions? How does food connect with the sublime? The class will include tastings and outings as scheduling permits.
Attribute/Distribution: CC, HE, HU

GS 015 (HIST 015) Three English Revolutions 4 Credits
The Protestant Reformation, the Civil Wars, and the Glorious Revolution, from Henry the Eighth to John Locke. Examines how three bloody conflicts gave birth to the first modern society. Explores the origins of empire, capitalism, secularization, nationalism, and democracy.
Attribute/Distribution: CC, HE, HU, Q

GS 017 (HIST 017) Democracy's Rise and Fall 4 Credits
The promise and perils of democracy from the ancient world to the present.
Attribute/Distribution: CC, SS, SW, W

GS 044 (REL 044) Religious Fundamentalism in Global Perspective 4 Credits
This course will explore the rise of fundamentalist religious movements and their involvement in violent conflicts. Topics to be considered will include the relationship between fundamentalist religious ideologies and terrorism, and the kinds of responses that fundamentalist religious movements present to the development of a global marketplace and the spread of secular nationalisms.
Attribute/Distribution: CC, HE, HU

GS 049 (HIST 049, LAS 049) The True Road to El Dorado: Colonial Latin America 4 Credits
Examines the initial encounters of peoples of Iberian and African origins with the indigenous civilizations of the Western Hemisphere. Explores the development of a colonial economy and its global reach. Focuses on the birth of a distinctive Latin American society and culture, with attention to the Latin American patriots who fought for their freedom. No prior knowledge of Latin American history required.
Attribute/Distribution: CC, SS, SW, W

GS 050 (HIST 050, LAS 050) Heroes, Dictators, and Revolutionaries: Latin America since Independence 4 Credits
Examines the 200-year-long struggle of Latin American peoples to gain political representation, economic equality, and social justice. Explores key historical events in Latin America from the movement for independence in the early nineteenth century to today's modern societies. Topics include the wars of independence, the rule of caudillos, foreign military interventions, export economies, populism, social revolutions, the Cold War era, state terror and military dictatorships, and the war on drugs.
Attribute/Distribution: CC, SS, SW, W

GS 070 (MLL 070) Other Voices: Being Human around the Globe 4 Credits
How do the processes of globalization affect human society and our concepts of culture and identity? What do societies gain and lose from their interactions with the rest of the world? What does it mean to be human in a globalized yet diverse world? This course grapples with such questions from the humanist’s point of view. Course materials include a broad selection of film, fiction, art, music, and theory, including both well-known pieces and newer works from under-represented global communities.
Attribute/Distribution: CC, HE, HU

GS 077 (ASIA 077, REL 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur’an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.
Attribute/Distribution: HE, HU, W

GS 091 Special Topics 1-4 Credits
Introductory-level study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, SS, SW

GS 100 (PHIL 100, POLS 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

GS 101 (HIST 101) Histories of Globalization 4 Credits
Critical historical perspectives on current debates around “globalization” and the varied paths and responses to modernity, using recent scholarship associated with the New Global History. The “Rise of the West” paradigm, Industrial Revolution and modernization theory; creation of global financial markets, nation-building and New Imperialism; Great Depression and World Wars as global historical events; postwar decolonization, Cold War and emergence of North-South relations; impact of consumerism, movements for women's rights, ethnic nationalism and religious fundamentalist movements in tradition-bound societies.
Attribute/Distribution: CC, HE, HU

GS 102 (COMM 102, DOC 102, FILM 102, JOUR 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society's most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN's "30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.
Attribute/Distribution: HE, HU

GS 106 (ANTH 106) Cultural Studies and Globalization 4 Credits
This course closely examines the complex relationship between culture and globalization. The impact of globalization on local culture is an essential topic. But the interaction of globalization and culture is not a oneway process. People around the world adapt globalization to their own uses, merging global cultural flows with local practices in transformative ways. The course will study the interaction of local culture with globalizing forces; immigration and culture; the localizing of mass culture; cultures of diasporic and migratory groups, and globalization, gender and identity.
Attribute/Distribution: SS

GS 107 (HIST 107) Science and Technology in the Making of the Modern World 4 Credits
This course covers world history from 1400, focusing on the rise of science, with important and wide-ranging implications for the modem world and the society we live in today. Global travel, exploration, trade, and technological innovations played essential roles in the exchange of knowledge and the development and rise of modem science. Science and technology have also contributed to the growing disparities in the modem world.
Attribute/Distribution: SS, SW, W

GS 108 (ANTH 108) Not-so-Lonely Planet: The Anthropology of Tourism 4 Credits
Love to travel? This course explores tourist attractions around the world to understand why people leave home, why they visit resorts, monuments, historical sites, memorials, parks, museums, and more. By reading anthropological scholarship and by visiting nearby attractions ourselves, we examine the politics and economics of the global tourism industry, the impact of tourism on local communities, and tourists' search for an 'authentic' experience. And we see how Disneyworld, of all places, provides insight into each of these topics.
Attribute/Distribution: CC, SS, SW, W

GS 117 (ANTH 117, LAS 117) Archaeology of Latin America 4 Credits
Explores the past of Latin America and the major civilizations that existed prior to European arrival and colonization. Extending from Mesoamerica through the Southern Andes, topics covered include the monumental structures, belief systems, and trade networks that made sure an entire continent was interconnected for millennia. This course also looks at the ways in which European colonialism has shaped the perception of these civilizations and how modern pseudoarchaeology continues to deny the accomplishments of indigenous cultures.
Attribute/Distribution: CC, SS, SW, W

GS 119 (ASIA 119, REL 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a "modern" religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.
Attribute/Distribution: CC, HE, HU, W

GS 124 (AAS 124, ART 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the AnteBellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santería), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

GS 125 (AAS 125, ART 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

GS 126 (ANTH 126) Urban Anthropology 4 Credits
When you think of anthropology, you probably picture exotic fieldsites: the Arctic, the Amazonian rainforests, the beaches of the South Pacific. But contemporary anthropologists are just as likely to study Tokyo, Berlin, or Bethlehem, PA. This course examines anthropology both in and of the city. How have anthropologists thought about the complexities of urban life? How can anthropology help us make sense of urban governance? What does belonging mean in a city that is racially or ethnically diverse?
Attribute/Distribution: CC, SS, SW, W

GS 127 (POLS 127) The Politics of Ending Global Poverty 4 Credits
Theories of poverty reduction meet the messy realities of social life around the world. Students in the course will understand why poverty persists and what kinds of solutions to it may be effective.
Attribute/Distribution: SS, SW

GS 129 (MLL 129) The Global Workplace: Preparing to Work around the World 4 Credits
This course uses modern literature and film to explore current theories of global and intercultural competence as well as practical approaches to the acquisition and development of skills needed to function effectively across cultural boundaries. We'll investigate changing definitions of work over time and across cultures and actively engage with contemporary global issues and the complexities of diverse cultural traditions.
Attribute/Distribution: CC, HE, HU, W

GS 131 (AAS 131, HIST 131, WGSS 131) Women, Gender, Sexuality and Race in African Societies 4 Credits
This course explores the various ways in which womanhood, gender, sexuality and race are defined, constructed and articulated in African societies. The interdisciplinary course draws from historical writings, novels, biography, anthropology, political science, health and other fields to examine diverse activities and contributions of African women from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

GS 140 (REL 140) Globalization and Religion 4 Credits
This course examines the complexity of globalization and its multi-layered impact on religious identity and piety. Though comparative in methodology and historical framework, the class will give special attention to Islam and Hinduism in South Asia. Topics include: European colonialism; Orientalism and its legacy; religious nationalism; Islamophobia; and the Internet and mass media.
Attribute/Distribution: CC, HE, HU, W

GS 143 (REL 143) Religious Nationalism in a Global Perspective 4 Credits
Religion has become a renewed political force on the world stage in recent years. This course will focus on how religion has often provided both the Ideological language and the organizing principles for many modern nationalisms. Our exploration of this topic will take the form of case studies from various parts of the world, including but not limited to Pakistan, Israel, No. Ireland, India, Iran and USA.
Attribute/Distribution: CC, HU, SW, W

GS 145 (ASIA 145, REL 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the changes and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: CC, HE, HU, W

GS 148 (REL 148) Islam Across Cultures 4 Credits
Explores the Muslim world's diversity and dynamism in multiple cultural contests-from the Middle East and North Africa, to Asia and America-through literature, ethnography, and films. Topics include: travel and trade networks; education; women and gender; Islam and cultural pluralism; colonialism; and identity politics.
Attribute/Distribution: CC, HE, HU, W

GS 151 (ENGL 151, FILM 151) Global Cinema 4 Credits
This course introduces students to contemporary filmmakers from Asia and Africa who have been inspired by globalization, dealing with issues such as mass migration, ethnic conflict and civil war, transnational finance and technology, and ongoing social and economic inequities. The course will be divided into four geographical units, with a representative mix of art films, popular genres (Bollywood and Nollywood), and global science fiction and horror. Filmmakers may include Mira Nair, Farah Akhtar, Bong Joon-ho, and Asghar Farhadi, among others.
Attribute/Distribution: CC, HE, HU, W

GS 152 (ASIA 152, MLL 152) Chinese Literature in the World 4 Credits
What place does Chinese literature occupy in the world? In this course we will read and discuss important works of modern Chinese fiction and drama alongside critical and theoretical writings on world literature. Student papers will integrate these discussions to reflect on questions such as center/periphery, national form, and canon formation. The course objectives are to introduce students to current debates on the topic of world literature and to resplendent modern Chinese short stories, novellas, and plays. Taught in English.
Attribute/Distribution: CC, HU, W

GS 155 (ANTH 155, HMS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will learn how social and cultural factors shape health outcomes in a variety of human contexts, and will study culturally specific approaches to healing, including Western bio-medicine. The course offers a broad understanding of the relationship between culture, health, and healing.
Attribute/Distribution: CC, SS, SW, W

GS 161 (JST 161, REL 161) Globalization in the Ancient Mediterranean 4 Credits
We often think of globalization as a modern phenomenon. Yet as early as the twelfth century BCE, transportation, trade, political and religious networks tied the Mediterranean basin together. This course will examine in three periods-the Late Bronze Age, the Hellenistic period, and the Roman period-how these networks were organized and how they affected a range of Mediterranean and Near Eastern peoples. We will use some modern approaches to globalization as analytical tools for understanding the ancient world.
Attribute/Distribution: HE, HU, W

GS 162 (HMS 162, SOC 162) HIV/AIDS and Society 4 Credits
Impact of the AIDS epidemic on individuals and on social institutions (medicine, religion, education, politics, etc.); social and health policy responses; international experience; effect of public attitudes and policy on people affected directly by AIDS.
Attribute/Distribution: CC, SS, SW

GS 173 (ANTH 173) Archaeology of the Middle East 4 Credits
Covers major archaeological findings from Iraq, Iran, Israel, Palestine, Jordan, Egypt, and Turkey, as well as historical context surrounding those findings. Learn about palaces, temples, fortresses, pyramids, tombs, and ancient cities that archaeologists have excavated—but also about who excavated these sites and why. Answer questions like: Who built the pyramids? How did writing begin? And: Why is the Rosetta Stone now in England? How has our knowledge of the past been shaped by the relationship between archaeology and colonialism?
Attribute/Distribution: CC, Q, SS, SW

GS 175 (HIST 175, JST 175, REL 175) History of Racism, anti-Semitism, and Islamophobia 4 Credits
From the history of slavery in the ancient world to Charlottesville 2017. We will read texts and watch movies that discuss the history of slavery, anti-Semitism, and Islamophobia. The historical meeting of worlds goes from "social slavery" in the ancient world to the "blood laws" in medieval Spain; colonialism in the New World, the rise of biological racism in the nineteenth century, and of cultural racism in the twentieth century.
Attribute/Distribution: CC, HE, SS, W

GS 176 (AAS 176, HIST 176, HMS 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students' final papers will perform a "post-mortem" on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: CC, HE, HU, W

GS 178 (AAS 178, HIST 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: CC, HE, SS, W

GS 183 (ART 183, HIST 183) France from Medieval to Modern:Soc., Pol. & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: CC, HE, HU

GS 184 (ARCH 184, HIST 184) Paris: The Global City 3 Credits
An overview of the development of the city of Paris from its origins as an outpost on the far reaches of the Roman Empire to its rise as capital of medieval Christendom, from seat of Absolute Monarchy to birthplace of modern revolutions, resistance and occupation in the era of world wars, and model of modern urban planning in the 19th, 20th and 21st centuries. Focus is on the way global contexts shaped social and political life at the local level.
Attribute/Distribution: CC, HE, HU

GS 187 (ANTH 187, ASIA 187) Contemporary Southeast Asia 4 Credits
Southeast Asia is said to be on the rise. But from where has Southeast Asia risen? And what are the social consequences of this so-called rise? Addressing these questions, this course provides a broad introductory overview of contemporary Southeast Asia, surveying the region's extraordinary diversity and ongoing political, economic, and sociocultural transformations. Through engagement with ethnographic materials, the course further explores how everyday Southeast Asians negotiate and contend with ongoing challenges associated with the forces of globalization.
Attribute/Distribution: CC, SS, SW

GS 191 Special Topics 1-4 Credits
General study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, SS, SW, W

GS 201 (ASIA 201, POLS 201) South Asian Politics 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest.
Attribute/Distribution: CC, SS, SW

GS 202 (ENGL 202, LAS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HE, HU

GS 221 (ART 221) Global Contemporary Art 4 Credits
Examines art and theory since World War II through the present in the global context. Topics include the development of abstract expressionism; conceptual art and the aesthetics of 1960s-era social movements; the politics of multiculturalism; the shift from contemporary to global in the 1990s; the rise of art biennials and the role of curators; post-Marxist and decolonial approaches to the arts; critical discourses on globalization; and issues of memory, trauma, migration, diaspora, and the environment. Includes museum and gallery visits.
Attribute/Distribution: CC, HE, HU, W

GS 246 (JOUR 246) International Communication 4 Credits
The subject matter is crucial to understanding modern life: the role of international news media in world affairs. The class studies the social, political and economic contexts that frame the reporting of international events by U.S. news media, such as politics, war, disasters, and other crises, as well as U.S. reporting on international issues, such as poverty, disease, and environmental change. The course also surveys reporting practices in nations around the world, including the varying systems of journalism and mass media and the brutal censorship and repression facing many foreign journalists.
Attribute/Distribution: SS

GS 247 (ASIA 247, REL 247) Islamic Mysticism 4 Credits
Sufism, the inner or 'mystical' dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition's impact on art and music, poetry and prose.
Attribute/Distribution: CC, HE, HU, W

GS 259 (FREN 259) Contemporary France 3-4 Credits
How is France defining itself today as a European nation in a global world? Issues to be explored include: family, gender, race and religion, the education and social systems, immigration, and politics. Strongly recommended for students who plan to study abroad in France.
Attribute/Distribution: HU, W

GS 291 Special Topics 1-4 Credits
Intermediate-level study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, SS, SW, W

GS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

GS 302 (ENGL 302, LAS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including "fantastic" narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: CC, HU

GS 314 (AAS 314, HMS 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: CC, SS, SW, W

GS 316 (ENGL 316) Native American Literature 3-4 Credits
This course is a survey of the literary texts written by the indigenous inhabitants of what is now the United States, beginning with the myths and legends of the era before European contact and ending with the novels, poems, and films produced by Native Americans in the twentieth- and twenty-first centuries.
Attribute/Distribution: HE, HU, W

GS 317 (AAS 317, ANTH 317) So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development 4 Credits
We are often motivated by the desire to "give back"-- feed the hungry, heal the sick, and help those less fortunate than ourselves. Anthropological research on humanitarian aid, development projects, and other interventions meant to improve human lives in various contexts shows us why these efforts often go awry. Focusing primarily on settings outside the U.S., students will consider the pitfalls of developmental and humanitarian interventions as well as the crucial role of local knowledge in addressing complex global problems.
Attribute/Distribution: CC, SS, SW, W

GS 319 (SOC 319) The Political Economy of Globalization 4 Credits
Studies the relationship among economic, political and cultural forces in an era of globalization, focusing on how global capitalism, the world market and local economics shape and are shaped by social, cultural, and historical forces. Topics include political and cultural determinants of trade and investment; culture and the global economy; global capitalism, especially studied through the lens of culture; globalization and patterns of economic growth; cross-cultural study of consumerism; and poverty and inequality.
Attribute/Distribution: CC, SS, SW, W, WRIT

GS 320 (ANTH 320) Global Capitalism 4 Credits
Anthropological approach to the forms and effects of global capitalism. Topics include the structure of contemporary global capitalism, including the growth of multinational corporations, flexible corporate strategies, overseas manufacturing, and global branding and marketing; the impact of global capitalism on the environment and on the lives of people in "Third World" countries; consumer culture and the diversity of non-Western consumption practices; alternative capitalist systems.
Attribute/Distribution: CC, SS, SW, W

GS 322 (HMS 322, SOC 322) Global Health Issues 4 Credits
Sociological dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of 'traditional' and 'modern' beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.
Attribute/Distribution: CC, SS, SW, W

GS 325 (POLS 325) Nationalism, Regionalism, and Populism 3,4 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.
Prerequisites: POLS 003
Attribute/Distribution: CC

GS 328 (SOC 328) Global Food Systems 4 Credits
Where does our food come from? How does it get to our tables? Why are there famines in some parts of the world and obesity epidemics in other parts of the world? This course will investigate these questions by focusing on food systems – the chains of social action that link food producers to food consumers. We will also explore a range of alternatives to global food systems that emphasize food democracy, security, and sustainability.
Attribute/Distribution: CC, SS, SW

GS 331 (SOC 331, WGSS 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: CC, SS, SW, W

GS 339 The Rise of the State in Modern East Asia 4 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.
Attribute/Distribution: SS

GS 341 (AAS 341, HIST 341) Global Africa: Aid, Volunteerism, NGO's and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: CC, HE, SS, W

GS 342 (POLS 342, WGSS 342) Gender and Third World Development 3-4 Credits
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect ‘real people?' How do economic theories affect men vs. women? What is the role of people who want to ‘help?' Some background in economic theories and/or Third World politics desired, but not required.
Prerequisites: POLS 001 or WGSS 001
Attribute/Distribution: SS

GS 343 (AAS 343, ASIA 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of “race” and its impact on domestic and international politics.
Attribute/Distribution: SS

GS 346 (MGT 346) International Business 3 Credits
This class provides an overview of international business, including the decisions, issues, and challenges faced by multinational enterprises and the environment in which they operate. This class will discuss why trade exists between nations and examine patterns in foreign direct investment. We will explore political, economic, cultural, and other differences between countries that are salient to international business. We will understand why businesses decide to create overseas subsidiaries, and the various choices available to them as they operate globally.

GS 347 (HIST 347) The French Revolution and Napoleon: A Global History 3,4 Credits
Global origins; breakdown of Absolute Monarchy; rise of Enlightenment culture and decadence of the court; storming of the Bastille and creation of republican government; invention of modern nationalism and Napoleonic military culture; women in political life; uses of mass propaganda, public festivals and transformation of the arts; political violence in the “Terror”; abolition of slavery and origins of Haitian Revolution; Napoleon's imperial system and warfare with Europe; impact on global imperial rivalries and revolutionary movements abroad.
Attribute/Distribution: CC, HE, HU, W

GS 348 (HIST 348) The British Empire and the Modern World 3-4 Credits
Examines the empire and its central role in the process of globalization between the 16th and 20th centuries. Topics include exploration, state-building, war, multinational corporations, industry, international finance, missionaries, racism, and independence movements.
Attribute/Distribution: CC, SW, W

GS 353 (ANTH 353, EVST 353) Ethnobotany: People and Plants 4 Credits
This course explores the meanings and uses given to plants by diverse cultures in their unique ecological settings. Ethnobotany combines botany and cultural anthropology to study how people classify, use, and manage plants for medicine, food, and ritual. This course introduces the history, methods, theory, and practical applications of ethnobotany, including plant conservation, sustainable development, and cultural survival. Special emphasis will be placed on learning to do ethnobotany through student research projects.
Attribute/Distribution: CC, SS, SW, W

GS 366 (ANTH 366) Power, Preparedness, Precarity: Urban Resilience in an Age of Uncertainty 4 Credits
We have learned to expect the end of the world as we know it: sea levels are rising, carbon fuel reserves are diminishing, global power structures are shifting. This course asks how we can respond both socially and materially in the face of uncertainty. How can urban planning be used as an instrument of social control--or social change? How do we conceptualize themes like crisis and the natural? And how are new imaginations of the built environment emerging in response.
Attribute/Distribution: CC, SS, W

GS 369 (ASIA 369, POLS 369, WGSS 369) Women's Movement in China 4 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, “did the Party liberate women?”
Attribute/Distribution: SS

GS 370 (EVST 370, SOC 370) Globalization and the Environment 4 Credits
This course investigates how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes, focusing on the rapidly evolving global economic and political systems that characterize global development dynamics and resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution are key themes.
Attribute/Distribution: CC, SS, SW, W

GS 390 Readings in Global Studies 1-4 Credits
Directed course of readings for students with interests in Global Studies not fully explored in regular offerings. Junior or senior standing required. Departmental permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, SW, W

GS 391 Special Topics 1-4 Credits
Intensive or highly in-depth study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, SS, SW, W

GS 392 Internship in Global Studies 1-4 Credits
Supervised work relevant to global studies, including internships at the United Nations, nongovernment organizations (NGOs), government organizations, and other public and private agencies. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

GS 394 Senior Thesis 1-4 Credits
A thesis project entails intensive, original research, undertaken under the direct supervision of a faculty adviser, either over the course of a semester or a year. While all GS students are encouraged to pursue research opportunities and complete a senior thesis, in order to receive departmental honors, Global Studies majors must earn a 3.5 major GPA, take GS 394: Senior Thesis, and receive an A grade in this course. Senior standing and departmental permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS, W

GS 399 Special Topics in Global Studies 1-4 Credits
Topics vary from semester to semester. Topics are addressed at an intermediate level. Previous course work in global studies and consent of faculty sponsor is required.
Repeat Status: Course may be repeated.

Health, Medicine, and Society

Website: http://hms.cas.lehigh.edu/ **(**http://hms.cas2.lehigh.edu/**)**

Interdisciplinary Health, Medicine, and Society major and minor programs are offered in the College of Arts and Sciences. A committee composed of faculty from several departments across the college developed and participate in the programs. Students interested in declaring a major or minor in Health, Medicine, and Society should contact the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280.

The challenge of meeting the increasingly complex health needs of growing and aging populations is moving to the forefront of national and international concerns in the 21st century. The Health, Medicine, and Society field focuses on the social scientific and humanistic dimensions of health and medical care to develop an understanding of the impact of health, illness, and medical care on individuals, families, and societies. This program is intended to serve students who wish to be involved in some aspect of the healthcare industry, public health, or health policy and also students who are interested in communications, the pharmaceutical industry, law, business, agency work, and other careers where understanding healthcare is essential.

Emeritus Faculty

Judith N. Lasker, professor emerita of sociology and anthropology and health, medicine and society.

The Health, Medicine, and Society major is jointly administered by the College of Arts and Sciences and the College of Health. The challenge of meeting the increasingly complex health needs of growing and aging populations is moving to the forefront of national and international concerns in the 21st century. The Interdisciplinary Health, Medicine, and Society Major focuses on the social scientific, humanistic, and applied community-engaged dimensions of health and medical care to develop an understanding of how health, illness, and medical care impact individuals, families, culture, and societies. The joint major is intended to serve students who wish to be involved in some aspect of the healthcare industry, health policy, or public health and also students who are interested in communications, the pharmaceutical industry, law, business, agency work, and other careers where understanding health care is essential.

MAJOR REQUIREMENTS

In addition to the 30-36 required credits, all HMS majors are required to have a second major. [1]

A minimum of 3 courses must be taken at the 300 level.

No more than two courses for a maximum of 8 credits may be taken outside of Lehigh, including non-Lehigh study abroad.

CORE REQUIREMENTS		**14-16**
Health Humanities Core Course		
HMS 170	Medical & Health Humanities	
or HMS/PHIL/REL/ETH 116	Bioethics	
Behavior, Culture, & Society Core Course		
HMS/PSYC 130	Introduction to Health Psychology	
or HMS/SOC 160	Medicine and Society	
Public Health Core Course		
POPH 001	Introduction to Population and Public Health	
or CGH 001	Community Health	
or CGH 004	Introduction to Global Health	
Health Research Methods Core Course		
POPH 002	Population Health Research Methods & Application	
or BSTA 001	Population Health Data Science I (Releveled to BSTA 101)	
or BSTA 005	Statistical Literacy in Health	
or CGH 106	Qualitative Methods in Health Research	
CONCENTRATIONS [1]		**9-12**
Students must take a minimum of 3 courses outside of the core requirements in a single one of the following concentrations:		
Health Humanities		
or		
Behavior, Culture, & Society		
or		
Public Health & Policy		
Please see below for lists of concentration courses.		
ELECTIVE REQUIREMENTS [1, 2, 3]		**6-8**
Take any 2 additional HMS courses (at least one of which must be outside of selected concentration)		

1

Students are required to meet the distribution requirements of the college they were admitted to, either the College of Health or the College of Arts & Sciences.
If a student pursues the required second major as a B.A. through another college, they are required to fulfill the distribution requirements listed for a CAS/CoH B.A.+B.A . Students who pursue a combination of a B.A.+ B.S. are required to petition for a dual degree.

2

No more than two courses outside of the core courses can come from cross-listed courses within the second major, and no more than 3 courses can double-count towards both majors regardless of home college.

3

Research methods required course should be chosen in consultation with Advisor. Major dependent courses that may meet this requirement include SOC 211 Research Methods and Data AnalysisResearch Methods and Data Analysis, PSYC 202 Research Methods and Data Analysis IIResearch Methods and Data Analysis II, IR 100 Methods and Research DesignMethods and Research Design, ECO 045 Statistical MethodsStatistical Methods, and BIOS 130 BiostatisticsBiostatistics.

4

A maximum of 4 credits of HMS 221 Peer Education FoundationsPeer Education Foundations, HMS 271 Independent StudyIndependent Study, HMS 292 Supervised ResearchSupervised Research, HMS 293 Internship Internship , or HMS 294 Health Equity InternshipHealth Equity Internship may fulfill the major elective or major concentration requirements.

CONCENTRATION AND ELECTIVE COURSES

Each semester, a complete list of HMS course offerings can be found on the HMS website. Other elective courses may be approved at the discretion of the program director.

HEALTH HUMANITIES CONCENTRATION

Take Three

HMS/REL/ETH 002	Death and Dying: Religious and Ethical Perspectives	
HMS/ETH/PHIL/REL 106	Bioethics and the Law	
HMS/ENGL 115	Topics in Literature, Medicine, and Health	
HMS/FILM 166	Topics in Film and Health	
HMS/HIST 118	History of Modern Medicine	
HMS 142	The Greek and Latin Roots of Medical Terminology	
HMS/AAS/HIST/GS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness	
HMS/REL/ETH 226	From Black Death to Covid-19:Plague,Pandemic,Ethics and Religion	
HMS/MLL 257	Traditional Chinese Medicine: Historical Perspectives	
HMS/SPAN/LAS 270	Spanish for the Health Professions	
HMS/ENGL 315	Topics in Literature, Medicine, and Health	
POPH 003	Justice, Equity, and Ethics in Population Health	
POPH 319	Population Health Bioethics	
Total Credits		**10-12**

BEHAVIOR, CULTURE, & SOCIETY CONCENTRATION

Take Three

HMS/POLS/EVST 110	Environmental Planning for Healthy Cities	
HMS/HIST/WGSS 125	Does Sex have a History? The History of Sexuality in the United States	
HMS/PSYC 138	Psychopathology	
HMS/COMM 150	Health Communication	
HMS/ANTH/GS 155	Medical Anthropology	
HMS/SOC 162	HIV/AIDS and Society	
HMS/PSYC 302	Stress and Coping	
HMS/POLS 307	The Politics of Mental Health Policy	
HMS/AAS/GS/SOC 314	Infections and Inequalities: HIV, TB and Malaria in the Global South	
HMS/PSYC 319	The Psychology of Trauma	
HMS/EVST/POLS 320	Food Justice in Urban Environments	
HMS/SOC/GS 322	Global Health Issues	
HMS/JOUR/EVST 323	Health and Environmental Controversies	
HMS 327/327/PSYC 327	Advanced Topics in Health Psychology	
HMS/PSYC/WGSS 334	The Psychology of Body Image and Eating Disorders	
HMS/PSYC 344	Health Care Reasoning and Decision Making	
HMS/PSYC 348	Drugs and Behavior	
HMS/PSYC 386	Pediatric Psychology	
ECO 368	Health Economics	
Total Credits		**11-12**

PUBLIC HEALTH & POLICY CONCENTRATION

Take Three

HMS 221	Peer Education Foundations	
HMS/POLS 307	The Politics of Mental Health Policy	
HMS/POLS 354	U.S. Health Care Politics	
CGH 004	Introduction to Global Health	
CGH 105	Commercial Determinants of Health	
CGH 107	What is the US Healthcare Ecosystem?	
CGH 305	Advanced Qualitative Methods in Community and Global Health	
CGH 306	Mixed Methods in Health Research	
CGH 307	Health Survey Research Methods	
CGH 308	Community Health Intervention Design	
CGH 313	Health Policy and Politics	
CGH 316	Global Environmental Disasters & Policy	
CGH 331	Healthcare Finance	
CGH 332	Aging, Health, and Social Policy	
CGH/HMS/EDUC 375	Community Based Participatory Research Methodology	
EPI 305	Intermediate Epidemiology	
EPI 306	Lifecourse Epidemiology	
POPH 105	Introduction to Maternal and Child Health	
Total Credits		**9-12**

Other courses and Electives

BIOS 010	Bioscience in the 21st Century	3
HMS 090	Freshman Seminar	1-4
EES 029	Human Health and the Environment	3
CGH 103	Biological & Environmental Determinants of Health	4
POPH 106	Global Environment and Human Welfare	3

CGH 120	Independent Study or Research in Community and Global Health	1-4
POPH 120	Independent Study or Research in Population Health	1-4
CGH 130	Internship in Community and Global Health	1-4
POPH 130	Internship in Population Health	1-4
CGH 150	Special Topics in Community and Global Health	3-4
POPH 150	Special Topics in Population Health	3-4
HMS 291	Special Topics	1-4
HMS 292	Supervised Research	1-8
HMS 293	Internship	1-8
BSTA 308	Advanced R Programming	3
EPI 310	Environmental Epidemiology & Exposure Science	3
CGH 315	Medical Mysteries	3
CGH 330	Internship in Community and Global Health	1-4
POPH 330	Internship in Population Health	1-4
CGH 350	Special Topics in Community and Global Health	3-4
POPH 350	Special Topics in Population Health	3-4
HMS 395	Miscellaneous	1-4

To declare an HMS major, contact the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280.

Minor REQUIREMENTS

The minor in HMS consists of one core course and elective courses for a total of 15-16 credits. To declare a minor in HMS or for a complete list of HMS course offerings, visit the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280. For study Abroad course approval, see program director.

Required Core Course (select one) [1]		
HMS/REL/PHIL 116	Bioethics	
HMS/PSYC 130	Introduction to Health Psychology	
HMS/SOC 160	Medicine and Society	
HMS 170	Medical & Health Humanities	
HMS 180	Introduction to Public Health	
Electives (select three courses from the list of core and elective courses) [2]		
Total credits [3]		**15-16**

1

If more than one core course is taken, core course may substitute for elective.

2

A maximum of 4 credits of HMS 221 Peer Education Foundations, HMS 291 Special Topics, HMS 292 Supervised Research, HMS 293 Internship , or HMS 294 Health Equity Internship may fulfill the minor elective requirement.

3

No more than one course for a maximum of 4 credits may be taken outside of Lehigh, including non-Lehigh study abroad.

Courses

HMS 002 (ETH 002, REL 002) Death and Dying: Religious and Ethical Perspectives 4 Credits
Introduces students to the study of religion, world religious traditions and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.
Attribute/Distribution: HE, HU

HMS 071 Independent Study 1-4 Credits
Independent research and reading with a faculty member. After receiving initial approval from the HMS director, the student must prepare an independent study proposal, with readings and assignments, in consultation with a professor who agrees to direct the independent study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

HMS 102 (SOC 102) Sociology of Mental Health 4 Credits
This course will provide an introduction to the sociology of mental health. You will learn how the social world influences our well-being, how the line between health and illness (“normal” and “crazy”) is socially constructed, and how mental health treatment has changed over time. We will also delve into demographic patterns of mental health and discuss the social stigma that surrounds mental illness, mental health treatment, and diagnosis. Throughout the course, we will discuss contemporary issues through a sociological lens.
Attribute/Distribution: CC, SS, SW

HMS 106 (ETH 106, PHIL 106, REL 106) Bioethics and the Law 4 Credits
Students in this course will learn something about the foundations and (nontechnical) workings of the American system of justice, and will combine that understanding with a focus on various topics in bioethics, from the "right to die" to gene-patenting. A key point will be the understanding that, as science and medicine continually move forward, there are always new challenges to existing legal understanding. How should the law respond to new questions, e.g. inheritance rights of posthumously conceived children?
Attribute/Distribution: HU

HMS 107 (PHIL 107, REL 107) Bio-Ethics and the Family 4 Credits
From reproduction to dying, this course will focus on how ethical issues in science and medicine highlight the role of the family. Issues include assisted reproduction and the role of gamete donors; genetic testing and the problem of misattributed paternity; the locus of decision making when patients are terminal or in pvs. Should our individual-orientated medical culture move toward a more family-oriented perspective?
Attribute/Distribution: HU

HMS 110 (ES 110, EVST 110, POLS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of "sustainability;" and grapple with the challenge of balancing communities' demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: CC, SS, SW

HMS 115 (ENGL 115) Topics in Literature, Medicine, and Health 4 Credits
Largely focused on narratives about health, illness and disability, this course will examine individual experiences with attention to social context. Topics may include the physician/patient relationship, illness and deviance, plague literature, gender and medicine, autism, AIDS, mental illness, aging.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

HMS 116 (ETH 116, PHIL 116, REL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: CC, HE, HU

HMS 118 (HIST 118) History of Modern Medicine 4 Credits
Introduction to Western medical history from the 18th century to the present day. Students will explore patient/practitioner relationships; examine changing ideas concerning health, sickness, and disease; chart changes in hospital care and medical education; and tackle topics such as eugenics, medical experimentation and health insurance.
Attribute/Distribution: HE, HU

HMS 120 (ETH 120, SOAN 120) Values and Ethics of Community-Engaged Research 4 Credits
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.
Attribute/Distribution: CC, SS, SW

HMS 125 (HIST 125, WGSS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. The class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: CC, HE, HU, W

HMS 130 (PSYC 130) Introduction to Health Psychology 4 Credits
This course explores the psychological processes that influence how people stay healthy, why people get sick, and how people respond to illness. The course also examines what the study of health psychology has to teach us about illness prevention and the provision of health care services. May not be taken pass/fail.
Attribute/Distribution: SS, SW

HMS 138 (PSYC 138) Psychopathology 4 Credits
Examines research and theory on the patterns, causes, and treatment of various forms of psychopathology. May not be taken pass/fail.
Prerequisites: PSYC 001
Attribute/Distribution: SS, SW

HMS 142 (CLSS 142) The Greek and Latin Roots of Medical Terminology 4 Credits
This course is an intro to scientific and medical terminology through the study of the core Greek and Latin roots and other elements (prefixes, suffixes) of this specialized vocabulary. Students will develop the skills needed to analyze a broad range of scientific and medical terms linguistically and to recognize their components in order to understand better the meaning of medical language. The course includes regular homework assignments, quizzes, and exams. No prior knowledge of Latin or ancient Greek is required.
Attribute/Distribution: HE, HU

HMS 150 (COMM 150) Health Communication 4 Credits
Knowledge of health communication is an essential foundation for anyone working in the field. Yet communicating about health is often complex and multi-faceted. To better understand health communication, we will explore the role of media and persuasion. We'll examine media coverage of health information; communications on risks and epidemics; theories and research of health behavior; effects of communication technologies on health communication; communicating about health data and information; health campaigns; engaging with individuals and communities with health messages and more.
Attribute/Distribution: SS, SW

HMS 151 (JST 151, PHIL 151, REL 151) Judaism, Medicine, and Bioethics 4 Credits
This class traces the relationship between Jews and medicine from 1100 to 2020. How does Jewish religion and culture cultivate an affinity for the healing arts? How does Jewish law, ethics, and culture inform contemporary bioethics?
Attribute/Distribution: HE, HU

HMS 155 (ANTH 155, GS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will learn how social and cultural factors shape health outcomes in a variety of human contexts, and will study culturally specific approaches to healing, including Western bio-medicine. The course offers a broad understanding of the relationship between culture, health, and healing.
Attribute/Distribution: CC, SS, SW, W

HMS 160 (SOC 160) Medicine and Society 4 Credits
Sociological perspectives on health, illness, and medical care. Focus on social epidemiology, social psychology of illness, socialization of health professionals, patient-professional relationships, medical care organization and policies.
Attribute/Distribution: CC, SS, SW

HMS 162 (GS 162, SOC 162) HIV/AIDS and Society 4 Credits
Impact of the AIDS epidemic on individuals and on social institutions (medicine, religion, education, politics, etc.); social and health policy responses; international experience; effect on public attitudes and policy on people affected directly by AIDS.
Attribute/Distribution: CC, SS, SW

HMS 166 (FILM 166) Topics in Film and Health 4 Credits
This course will involve extended study in a sub-area of Film with a focus on health, medicine, and/or illness.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

HMS 170 Medical & Health Humanities 4 Credits
The focus on social determinants, individual voices, cultural representations, and particular historical moments from the perspective of the humanities disciplines has much to add to our understanding of health, illness, and medicine. This course will take up historical, literary, ethical, and theoretical approaches to health.
Attribute/Distribution: CC, HE, HU, W

HMS 171 Independent Study 1-4 Credits
Independent research and reading with a faculty member. After receiving initial approval from the HMS director, the student must prepare an independent study proposal, with readings and assignments, in consultation with a professor who agrees to direct the independent study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 176 (AAS 176, GS 176, HIST 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students' final papers will perform a "post-mortem" on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: CC, HE, HU, W

HMS 180 Introduction to Public Health 4 Credits
This course provides historical perspective on the contributions and roles of public health; introduces health status indicators of morbidity and mortality, concepts of rate, causation, and public health surveillance and vital statistics; and addresses determinants of health from an environmental, social, behavioral perspective. Aspects of health care delivery will be addressed from a population perspective and organizational structure. Not available for credit for students who have completed POPH 001.
Attribute/Distribution: CC, SS

HMS 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

HMS 216 (ETH 216, PHIL 216, REL 216) Research Ethics 4 Credits
Research with human and animal subjects carries with it a host of ethical and legal obligations. Topics include the history of human subjects research; ethical use of placebo studies; the ethics of research in developing countries; whether there is an ethical obligation to volunteer to be a research subject.
Attribute/Distribution: HU

HMS 221 Peer Education Foundations 2 Credits
This course prepares students to be peer educators at Lehigh. This course will focus on foundational education skills for peer educators including educational and development theories, identity development, educational needs assessments, educational goal setting, managing sensitivities in the classroom, educational delivery methods, strategies, and assessment. Particular attention will be given to creating trauma-informed and inclusive classrooms. Students completing the course are eligible to serve in other peer educator roles and should note that this commitment and others are extracurricular.
Attribute/Distribution: SS

HMS 226 (ETH 226, REL 226) From Black Death to Covid-19:Plague,Pandemic,Ethics and Religion 4 Credits
An investigation into the ways religion and morality shape interpretations of plague and pandemics. Three specific pandemics are examined: the bubonic plague of the 14th century, the 1918 Spanish Flu pandemic, and the current global Covid-19 crisis. Moral issues provoked by institutional, political and social responses to pandemic disease are also considered.
Attribute/Distribution: HE, HU, W

HMS 257 (ASIA 257, HIST 257, MLL 257) Traditional Chinese Medicine: Historical Perspectives 4 Credits
This seminar focuses on conceptions of the human body and health that evolved from the ancient through early modern times. Special attention is paid to healing strategies, the roles of healers and patients, and the evolution of a medical canon. The course materials are in English.
Attribute/Distribution: HE, HU, W

HMS 270 (LAS 270, SPAN 270) Spanish for the Health Professions 4 Credits
For prospective medical personnel communicating with Spanish-speaking patients. Healthcare vocabulary, patient-provider interaction, and cultural background of the Latino patient.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU

HMS 271 Independent Study 1-4 Credits
Independent research and reading with a faculty member. After receiving initial approval from the HMS director, the student must prepare an independent study proposal, with readings and assignments, in consultation with a professor who agrees to direct the independent study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 274 (BIOS 274) Neuroethics 3 Credits
The intersection of neuroscience and ethics. History of biomedical science and current topics in neuroethics explored through weekly case studies and relevant readings in neurobiology. Examples include: definitions of mental illness, definitions of consciousness and brain death, addiction neuroscience, brain-machine interfaces, wearable technology, social determinants of health and equity within science and medicine. Reading and critical analysis of scientific articles, integration of biological concepts with moral reasoning, effective written communication and participation in peer review, oral presentations and group discussions.
Prerequisites: BIOS 044
Attribute/Distribution: NS, W

HMS 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

HMS 292 Supervised Research 1-8 Credits
Research project under the direct supervision of an HMS faculty member. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

HMS 293 Internship 1-8 Credits
Student designed internship that provides practical experience in the application of health, medicine and society for both on- and off-campus organizations. Students must find the internship on their own and submit an application to the HMS program director. Upon approval, course will provide credit for supervised experiential learning experiences. Students are responsible for obtaining any clearances required by internship host agency. May be repeated for credit up to eight credits.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

HMS 294 Health Equity Internship 1-8 Credits
Students will work with a combination of staff and faculty from the Hispanic Center, St. Luke's, and Lehigh University to assist in developing programs at the Hispanic Center LV, the emerging Center for Integrative Health, and with other community agencies to promote health equity and reduce health disparities for the South Bethlehem community. Students may participate in activities related to data collection, program management, marketing of community/public health initiatives, outreach, and grant writing. Application and clearances required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, W

HMS 298 1-4 Credits
Repeat Status: Course may be repeated.

HMS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

HMS 302 (PSYC 302) Stress and Coping 4 Credits
How does stress affect the psychological system, and what psychological mechanisms are in place to help people overcome environmental stressors? This seminar examines classic and contemporary theories and research on stress, coping, and social support.
Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180
Attribute/Distribution: SS

HMS 307 (POLS 307) The Politics of Mental Health Policy 4 Credits
What is normal behavior, and how do we come to understand mental illness? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

HMS 314 (AAS 314, GS 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: CC, SS, SW, W

HMS 315 (ENGL 315) Topics in Literature, Medicine, and Health 3-4 Credits
Analyzing the stories people tell about health, illness and disability, this course engages cultural studies approaches in order to explore the way those stories are told. Topics may include: illness and the graphic novel, the changing image of the healer in literature, collaborative storytelling with Alzheimer's patients, end of life narratives, tales from the ER, narrative ethics.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

HMS 319 (PSYC 319) The Psychology of Trauma 4 Credits
This course explores the nature of psychological trauma, including the physiological, emotional, cognitive, behavioral, interpersonal, and developmental impact of exposure to extreme stress and traumatic events. Historical and current perspectives on the individual and cultural effects of trauma will be examined, including consequences of relational trauma, traumatic loss, injury/illness, crime, combat exposure, terrorism, natural disasters, and vicarious traumatization. Posttraumatic Stress Disorder and related conditions will be explored, as will the nature of effective intervention techniques, recovery, adaptive coping, and resilience.
Prerequisites: PSYC 138 or HMS 138
Attribute/Distribution: SS

HMS 320 (EVST 320, POLS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.
Attribute/Distribution: CC, SS

HMS 322 (GS 322, SOC 322) Global Health Issues 4 Credits
Sociological dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of 'traditional' and 'modern' beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.
Attribute/Distribution: CC, SS, SW, W

HMS 323 (EVST 323, JOUR 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks, and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.
Attribute/Distribution: SS, SW

HMS 327 (PSYC 327) Advanced Topics in Health Psychology 4 Credits
This course provides an overview of the psychological study of health. The course explores psychological theories that aim to explain health behavior (e.g., why do people smoke?) and the role of psychology in understanding the experience of illness. This course also examines how psychological research and theory can be applied to promote health behavior (e.g., how can we design interventions to promote physical activity).
Prerequisites: PSYC 130 or HMS 130
Attribute/Distribution: SS, W

HMS 331 Latino Health 4 Credits
The course is designed to provide a rich understanding of the factors at the individual, health care provider, institution, and policy that affect Latino health and health seeking-behaviors in the United States. Research in the disciplines of social and behavioral sciences, epidemiology, health promotion, environmental health, minority health and health disparities, and public policy will be reviewed and discussed.
Attribute/Distribution: SS, SW

HMS 334 (PSYC 334, WGSS 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.
Attribute/Distribution: SS, W

HMS 344 (PSYC 344) Health Care Reasoning and Decision Making 4 Credits
Health care professionals diagnose physical and mental illnesses and create treatment plans to improve their patients' health. How do these professionals make decisions related to these important issues? We will explore the literature on how medical and mental health professionals reason and make decisions about health care issues. Topics to be covered include diagnosis, treatment decisions, access to care, and how these reasoning processes are swayed. Consideration will be given to patient decision-making as well.
Prerequisites: PSYC 117 or COGS 117 or PSYC 130 or HMS 130 or COGS 007 or HMS 160 or HMS 180
Attribute/Distribution: SS, W

HMS 348 (PSYC 348) Drugs and Behavior 4 Credits
Why are some people more vulnerable to substance use problems than others? How can we effectively address substance abuse in our society? This course explores theories and research on the complex psychological, social, and biological factors that contribute to substance use and disorders. Topics include theories of addiction, characteristics of illegal and legal drugs, risk and protective factors, and research on substance abuse prevention.
Prerequisites: PSYC 130 or HMS 130 or HMS 160 or HMS 180
Attribute/Distribution: SS, W

HMS 349 (PSYC 349) Participatory and Action Research in Psychology 4 Credits
Action research is used to understand important real-world social problems and promote social action. Participatory research engages community members as equals to help identify areas of focus and to design studies and interventions. This course provides an overview of the rich history of these approaches in psychology, an in-depth look at how they can be used effectively, and an opportunity to gain hands-on experience.
Prerequisites: PSYC 121 or PSYC 153 or PSYC 130 or HMS 130 or HMS 160 or HMS 180
Attribute/Distribution: SS

HMS 354 (POLS 354) U.S. Health Care Politics 4 Credits
Explores a range of health care programs and policies and their impacts on American society. Topics include the development of the U.S. approach to health care; public sector plans (Medicare and Medicaid); the role of managed care; the employer-sponsored system; the situation of the medically uninsured; the health care vested interests and lobbyists; movements for national health care; and options for change.
Attribute/Distribution: CC, SS

HMS 371 Independent Study 1-4 Credits
Independent research and reading with a faculty member. After receiving initial approval from the HMS director, the student must prepare an independent study proposal, with readings and assignments, in consultation with a professor who agrees to direct the independent study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 375 (CGH 375, EDUC 375) Community Based Participatory Research Methodology 3-4 Credits
The course provides an introduction to the core concepts of community based participatory research (CBPR) methodology applied to social science research to address public health issues. The course will equip students with strategies for developing community academic partnerships as well as to strengthen skills in research methods.
Attribute/Distribution: SS

HMS 379 (PSYC 379) Grief, Anxiety, and Resilience 4 Credits
Grief and anxiety are familiar experiences for many people, and for some they can become debilitating. How can we understand the role these experiences play in a person's life? In this course, we will explore diverse perspectives on grief and anxiety. We will also explore the possibility of being resilient to these experiences, even becoming stronger in the face of adversity. As part of this exploration, we will spotlight the biographies of historical figures who have written about their experiences.
Prerequisites: PSYC 121 or PSYC 130 or PSYC 153 or HMS 130 or HMS 160 or HMS 180 or SOC 160
Attribute/Distribution: SS

HMS 380 (POLS 380, WGSS 380) The End of Policing? Politics of Social Control 4 Credits
"What are your prime directives? Serve the public trust, protect the innocent, uphold the law" (Robocop 1987). This course focuses on policy design and feedback and is not a course on police procedure or policing tactics. The primary objective of the course is to learn to think critically about public safety and evaluate policies based on their value to democracy.
Attribute/Distribution: CC

HMS 386 (PSYC 386) Pediatric Psychology 4 Credits
Focuses on developmental research and theory related to health and wellness issues in children and adolescents. Topics include children's understanding of biology and disease, disease management, medical consent, education and policy efforts to promote children's health.
Prerequisites: PSYC 107 or PSYC 130 or HMS 130
Attribute/Distribution: SS

HMS 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

History

The Department of History continues the legacy of liberal arts education within the research institution. The Department offers Lehigh students the undergraduate major and minor, the M.A., and the Ph.D.

History majors are uniquely equipped for understanding our ever-changing world and the diversity of the human experience. Our majors study the causes and consequences of change and learn to see the world from the perspectives of others.

As History majors practice the arts of explanation and empathy, they also cultivate a broad set of research, communication, and critical thinking skills. These skills include the location and analysis of texts, data, and evidence; the mastery and synthesis of large bodies of written and visual media; the furnishing of written and oral arguments and descriptions; the evaluation of the arguments of others; and the application of interpretive, quantitative, and digital tools.

Our majors are encouraged to hone all these skills in the process of independent research conducted under faculty guidance, either in the Capstone Experience (HIST 302) or the more ambitious Honors Thesis (HIST 393, 394). They are also encouraged to craft the major to their own particular interests, either by pursuing a geographically broad historical education or by concentrating on a particular region or theme that interests them. Concentrations pursued by our majors include War, Empire, and Revolution; Women, Gender, and Sexuality; Global Connections; Race, Ethnicity, and Diasporas; Religion, Thought, and Culture; and Medicine, Technology, and Environment.

In all of these ways, History majors acquire a unique blend of social-scientific and humanistic knowledge. They assemble an unusually wide body of applicable skills and knowledge. These skills serve our students well in an almost limitless variety of careers, from law, education, journalism, and public affairs to business and medicine. Accordingly, the major also positions students well for graduate training in history, law, public policy, business, and medicine. History majors get what they need to thrive in a rapidly changing workplace, to be active and informed citizens, and to cultivate lifelong learning.

MAJOR REQUIREMENTS
Students have two options in pursuing a History Major: one emphasizes geographic breadth and the other a thematic track. With departmental approval students may also pursue History Honors.

Option 1: History Major - Geographic Breadth

Required Courses		
HIST 001	Time Travel: How to Make History	4
HIST 302	The Capstone Experience	4
Select at least one course from four of the categories below [1]		**16**
North America		
HIST 041	The Making and Breaking of the United States	
HIST 042	Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941	
HIST 043	The United States Since 1941	
HIST 105	Sports in Modern America	
HIST 110	American Military History	
HIST 112	Takin' It to the Streets: The Global Sixties	
HIST 120	Revolutionary America	
HIST/WGSS 124	Women and Gender in US History	
HIST/HMS/WGSS 125	Does Sex have a History? The History of Sexuality in the United States	
HIST/AAS/WGSS 126	How Black Women Made Modern America	
HIST 137	Coming to America: U.S. Immigration History	
HIST/AAS 130	African American History	
HIST 135	Era of Jefferson and Jackson	

HIST 136	Era of the Civil War and Reconstruction
HIST/AAS 179	Black Political Thought in America
HIST/EVST 315	American Environmental History
HIST 319	Colonial America
HIST 320	History of North American Indians
HIST/SOC/WGSS 325	History of Sexuality and the Family in the U.S.
HIST/AAS 332	Slavery and the American South
HIST 336	Bethlehem and the Lehigh Valley
HIST 367	Rise and Fall of the Old South
Europe	
HIST 012	Inventing the Modern World: Europe in Global Perspective, 1648-present
HIST/GS 015	Three English Revolutions
HIST/GS 017	Democracy's Rise and Fall
HIST 021	Greek History
HIST 022	Roman History
HIST 150	Medieval Civilization
HIST/JST/REL 154	The Holocaust: History and Meaning
HIST/ART/GS 183	France from Medieval to Modern:Soc., Pol. & Art
HIST/GS 347	The French Revolution and Napoleon: A Global History
HIST/GS 348	The British Empire and the Modern World
HIST 350	19th Century Paris and the Invention of Modernity
HIST 354	History of Global Fascism
Latin America	
HIST/GS/LAS 049	The True Road to El Dorado: Colonial Latin America
HIST/GS/LAS 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence
HIST/LAS 149	Narcos: The Global Drug Wars
HIST 368	Seminar in Latin American History
HIST/LAS 369	Columbus on Trial: A Critical Reading of the Spanish Conquest
Africa	
HIST/AAS 005	African Civilization
HIST/AAS 130	African American History
HIST/AAS/GS/ WGSS 131	Women, Gender, Sexuality and Race in African Societies
HIST/AAS 134	History and Cultures of Ghana
HIST/AAS/GS/HMS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness
HIST/AAS/GS 178	Globalization and Health in Ghana
HIST/AAS/WGSS 322	African Women, Voices and Lives
HIST/AAS 330	Africans and the Atlantic World
HIST/AAS 331	United States and Africa
HIST/AAS/GS 341	Global Africa: Aid, Volunteerism, NGO's and International Studies
Asia	
HIST/JST 031	Empire, War, and Resistance in the Middle East
HIST/ASIA 080	In Search for Modern China
Transnational	
HIST 025	Pirates of the Caribbean and Other Rogues of the Atlantic World
HIST/JST 031	Empire, War, and Resistance in the Middle East
HIST/LAS/GS 049	The True Road to El Dorado: Colonial Latin America
HIST/LAS/GS 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence
HIST/GS 101	Histories of Globalization
HIST/GS 107	Science and Technology in the Making of the Modern World
HIST 112	Takin' It to the Streets: The Global Sixties
HIST 121	From Alexander the Great to Cleopatra
HIST 137	Coming to America: U.S. Immigration History
HIST/LAS 149	Narcos: The Global Drug Wars
HIST/AAS/GS/HMS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness
HIST/AAS/WGSS 322	African Women, Voices and Lives
HIST/AAS 330	Africans and the Atlantic World
HIST/AAS 331	United States and Africa
HIST/AAS/GS 341	Global Africa: Aid, Volunteerism, NGO's and International Studies
HIST/GS 348	The British Empire and the Modern World
HIST 352	History of Total War
HIST 354	History of Global Fascism
Elective Requirement [1]	**11**
Additional courses to meet the minimum of 35 credits	
Total Credits	**35**

[1]

From the 35 credits, majors must have 12 credits (3 courses) at 303 and above; and 4 credits (1 course) in the pre-1800 period.

Option 2: History Major - Thematic Track

Required Courses		
HIST 001	Time Travel: How to Make History	4
HIST 302	The Capstone Experience	4
Tracks [1,2]		**12**
Select three courses (12 credits) from one of the tracks below		
Global Connections Track		
HIST 005	African Civilization	
HIST 012	Inventing the Modern World: Europe in Global Perspective, 1648-present	
HIST/GS 015	Three English Revolutions	
HIST/GS 017	Democracy's Rise and Fall	
HIST 025	Pirates of the Caribbean and Other Rogues of the Atlantic World	
HIST/JST 031	Empire, War, and Resistance in the Middle East	
HIST/GS/LAS 049	The True Road to El Dorado: Colonial Latin America	
HIST/ASIA 080	In Search for Modern China	
HIST/GS 101	Histories of Globalization	
HIST/GS 107	Science and Technology in the Making of the Modern World	
HIST 112	Takin' It to the Streets: The Global Sixties	
HIST 121	From Alexander the Great to Cleopatra	
HIST 137	Coming to America: U.S. Immigration History	
HIST 175	History of Racism, anti-Semitism, and Islamophobia	

HIST/AAS/GS/HMS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness
HIST/AAS/GS 178	Globalization and Health in Ghana
HIST/ART/GS 183	France from Medieval to Modern:Soc., Pol. & Art
HIST/ARCH/GS 184	Paris: The Global City
HIST/AAS/WGSS 322	African Women, Voices and Lives
HIST/AAS 330	Africans and the Atlantic World
HIST/AAS 331	United States and Africa
HIST/AAS/GS 341	Global Africa: Aid, Volunteerism, NGO's and International Studies
HIST/GS 347	The French Revolution and Napoleon: A Global History
HIST/GS 348	The British Empire and the Modern World
HIST 352	History of Total War
HIST 369	Columbus on Trial: A Critical Reading of the Spanish Conquest
Women, Gender, and Sexuality Track	
HIST 041	The Making and Breaking of the United States
HIST 042	Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941
HIST 043	The United States Since 1941
HIST/WGSS 124	Women and Gender in US History
HIST/HMS/WGSS 125	Does Sex have a History? The History of Sexuality in the United States
HIST/AAS/GS/ WGSS 131	Women, Gender, Sexuality and Race in African Societies
HIST 135	Era of Jefferson and Jackson
HIST 136	Era of the Civil War and Reconstruction
HIST/AAS/WGSS 322	African Women, Voices and Lives
HIST/SOC/WGSS 325	History of Sexuality and the Family in the U.S.
War, Empire, and Revolution Track	
HIST 005	African Civilization
HIST 012	Inventing the Modern World: Europe in Global Perspective, 1648-present
HIST/GS 015	Three English Revolutions
HIST/JST 031	Empire, War, and Resistance in the Middle East
HIST 041	The Making and Breaking of the United States
HIST 043	The United States Since 1941
HIST/GS/LAS 049	The True Road to El Dorado: Colonial Latin America
HIST/GS/LAS 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence
HIST/ASIA 080	In Search for Modern China
HIST/GS 101	Histories of Globalization
HIST 110	American Military History
HIST 120	Revolutionary America
HIST 136	Era of the Civil War and Reconstruction
HIST/JST/GS/REL 175	History of Racism, anti-Semitism, and Islamophobia
HIST/EVST 315	American Environmental History
HIST 319	Colonial America
HIST/GS 347	The French Revolution and Napoleon: A Global History
HIST/GS 348	The British Empire and the Modern World
HIST 352	History of Total War
HIST/LAS 369	Columbus on Trial: A Critical Reading of the Spanish Conquest
Race, Ethnicity, and Diasporas Track	
HIST 041	The Making and Breaking of the United States
HIST 042	Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941
HIST 043	The United States Since 1941
HIST/GS/LAS 049	The True Road to El Dorado: Colonial Latin America
HIST 112	Takin' It to the Streets: The Global Sixties
HIST/AAS/WGSS 126	How Black Women Made Modern America
HIST/AAS 130	African American History
HIST/AAS/GS/ WGSS 131	Women, Gender, Sexuality and Race in African Societies
HIST 135	Era of Jefferson and Jackson
HIST 136	Era of the Civil War and Reconstruction
HIST 137	Coming to America: U.S. Immigration History
HIST/JST/GS/REL 175	History of Racism, anti-Semitism, and Islamophobia
HIST/AAS 179	Black Political Thought in America
HIST 319	Colonial America
HIST 320	History of North American Indians
HIST/AAS 330	Africans and the Atlantic World
HIST/AAS 331	United States and Africa
HIST/AAS 332	Slavery and the American South
HIST/AAS/GS 341	Global Africa: Aid, Volunteerism, NGO's and International Studies
HIST 354	History of Global Fascism
HIST 367	Rise and Fall of the Old South
Religion, Thought, and Culture Track	
HIST/GS 015	Three English Revolutions
HIST/GS 017	Democracy's Rise and Fall
HIST 041	The Making and Breaking of the United States
HIST 042	Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941
HIST 043	The United States Since 1941
HIST/AAS 134	History and Cultures of Ghana
HIST/JST/REL 154	The Holocaust: History and Meaning
HIST 354	History of Global Fascism
Medicine, Science, Technology, and Environment Track	
HIST 007	Technology in America's Industrial Age
HIST 008	Technology in Modern America
HIST 025	Pirates of the Caribbean and Other Rogues of the Atlantic World
HIST/GS 107	Science and Technology in the Making of the Modern World
HIST 112	Takin' It to the Streets: The Global Sixties
HIST/HMS 118	History of Modern Medicine
HIST/AAS/GS/HMS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness
HIST/AAS/GS 178	Globalization and Health in Ghana
HIST/EVST 315	American Environmental History
Build Your Own Track	

Create your own track with the help of your advisor. Department approval required.

Elective Requirement [2]	**15**

Additional courses to meet the minimum of 35 credits.

[1]

With Department approval, majors may take one relevant course outside of History to fulfill track requirements. For descriptions of tracks and region and time period designations, and for additional courses that might qualify for tracks or geographical focus, see the History Department website (https://history.cas2.lehigh.edu/).

[2]

From the 35 credits, majors should have 12 credits (3 courses) at 303 and above (excepting HIST 306); 4 credits (1 course) in the pre-1800 period; and 4 credits (1 course) in Latin American, African or Asian History.

Requirements for honors

- Fulfillment of major requirements
- minimum of 3.5 GPA in courses presented for the Major
- HIST 393 Honors Thesis in History (4 credits) and HIST 394 Honors Thesis in History (4 credits)
- *With departmental approval these courses may be substitutes for the 302 The Capstone Experience*.

HISTORY MINOR REQUIREMENTS

Each student's minor program is prepared in consultation with the advisor of minors in the history department. Advanced placement credit may not be used for the minor program.

The minor consists of a minimum of 15 credits.

At least 4 credits must be at the 200 or 300 level.

Maximum of one course (4 credits) of transfer or cross-listed courses may count toward the minor.

CONCENTRATION IN PUBLIC HISTORY

History majors may earn a concentration in Public History by completing a total of 16 hours in the following courses:

HIST 305	Public History (required)	4
HIST 306	Internship in Public History (required)	4
Select at least two of the following:		8
ART 175	Introduction to Museums and Museum Professions	
ART 275	Museum Collections and Exhibitions	
ART 370	Special Topics in Museum Studies	
ART 375	Museum Internship	
HIST 336	Bethlehem and the Lehigh Valley	
HIST 338	Course HIST 338 Not Found (2-4 credits, may be repeated for up to 8 credits)	
HIST 339/370/ANTH 370	Course HIST 339 Not Found	
Total Credits		**16**

GRADUATE WORK IN HISTORY

Lehigh University has been granting advanced degrees in history for more than seventy years. Its graduates have become university and college professors, secondary school teachers and administrators, museum directors, and public servants. The graduate program offers a wide range of courses that reflect strengths across the faculty, including 19th and 20th century US History; Latin American, Caribbean, West African and Atlantic African-Diaspora history; British, French and Spanish Atlantic World Empires; and African-American history. Course offerings also reflect thematic approaches across time and space, including: Digital Humanities; Public History; Gender History; the History of Technology; American and European Intellectual History; and the Cultural History of Warfare.

The department has close ties with the Lawrence Henry Gipson Institute for Eighteenth Century Studies which sponsors yearly symposia and provides research support for both faculty and students. The history of technology program is closely tied to Lehigh's Science, Technology, and Society program. Lehigh's libraries are especially rich in materials for graduate research in history, including a rare books collection and an extensive collection of scholarly periodicals and monographs. Graduate programs provide intensive and specialized study, and the policy of limited enrollment permits close relations between faculty and students.

Admission to graduate study in history is competitive and dependent upon the applicant's undergraduate preparation and record, recommendations, and Graduate Record Examination scores. Besides general requirements for College of Arts and Sciences graduate programs, the following special requirements apply to graduate study in history.

Master of Arts

Graduate Program

The Lehigh History graduate program offers training in preparation for a career in research and teaching as well as non-academic pursuits. The overarching theme of the program is **Transnational History.** Courses related to this theme are offered by faculty members across the department, over a wide range of geographical regions and chronological periods. Coursework focuses on developing both the fundamentals of historiographical analysis and historical research methods. The MA is designed to be a generalist degree that can prepare students for a number of careers or for more advanced graduate work. Former graduates work in a variety of areas including secondary education, public history, library services, business and government positions. The program provides training for those seeking to teach Global, transnational US, Atlantic World, European, African, Middle Eastern or Latin American histories at the secondary or community college level, as well as for those who will continue on to more advanced graduate work and a career in research and college level teaching.

Admission to the PhD. program is not automatic for students who complete the MA at Lehigh. Prospective PhD. students are encouraged to identify specific fields of interest and faculty members with whom they would like to work. At the PhD. level, students may consider department strengths in the following areas:

- African and Atlantic African-Diaspora History
- Latin American and Caribbean History
- British, French and Spanish Atlantic World Empires
- Early Modern and Modern European Intellectual History
- Holocaust, Genocide, Human Rights and Refugee Studies
- Ottoman Empire and Islamic World History
- Modern Chinese History
- Colonial America and Early American Republic
- Native American History
- Gender History
- 20th century US History
- African-American History

Students applying for the PhD. program should consult the list of faculty bios (https://history.cas2.lehigh.edu/faculty/) to learn more about these research specialties to help determine their compatibility with potential mentors. Not all fields may be accessible in a given year, given faculty leaves and mentoring duties. Applicants should contact faculty members directly if they have questions about the possibility of working on a related research field, or they may contact the Graduate Director, Professor Nitzan Lebovic (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/history/nil210@lehigh.edu) with any questions about this process.

Information for Applying to the History Department Graduate Program

The most important elements of the application file for the review process are:

--The personal statement which details the student's interest in pursuing graduate study in History.
- The applicant's academic record, with special emphasis on their performance in history and related subjects.

- Recommendation letters from two or three faculty mentors who can speak to the applicant's potential for graduate work in the discipline. One of these letters may come from a former employer or non-academic mentor if they can speak to related skill sets the applicant may possess.

- GRE scores are required, though they are rarely the determining element in an application file. A strong performance on the Verbal section of the GRE is what is most important.

- The ability to write clearly and intelligently as demonstrated by a relevant writing sample, perhaps drawn from a seminar or research paper completed for a recent course, or a chapter or section of a thesis. Please limit submissions to about twenty pages maximum (excluding notes and bibliography). **All materials are to be uploaded on the online application.

Financial Awards and Deadlines

PhD students are normally supported by a package of five or six years of fellowship and TA-ship funding. Limited fellowship, TA-ship, and scholarship support is available to MA students each year, depending upon the size the graduate student population and the number of financial support offers being made to PhD applicants.

To be considered for financial support as an incoming student, all materials must be submitted by **January 15**. If you are not seeking financial aid, the deadline for applications for the fall semester is **April 15**.

For additional information on the graduate program or to schedule a campus visit, please contact the graduate program director, Professor Nitzan Lebovic at nil210@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/history/nil210@lehgh.edu)

What is Transnational History?

Transnational History has emerged in recent years as an umbrella term for a variety of approaches that seek to capture dynamic change over time in ways that go beyond traditional historiographies bounded by national frameworks. Transnational History aims to put national developments in broader regional and global context, and to explain them in terms of cross-national influences as well as local causes. Transnational History may also consider the dissemination, circulation, and evolution of ideas, people, commodities, material culture, and spiritual practices in relation to changing political and social dynamics and fluid cultural identities, including national, religious, racial and gender identities. As such, Transnational approaches have influenced cutting edge scholarship across many scholarly subfields and are reshaping the teaching of basic survey courses in US history, World history and beyond.

M.A. Program Requirements

The M.A. is conferred upon students who meet the requirements listed below within six years of entering Lehigh. The MA may be either a terminal degree or a step toward the doctorate. Those wishing to go on for a Ph.D. at Lehigh must apply separately for that program by the beginning of the final MA semester, with the principal requirement being that they must have the agreement of a faculty adviser who will direct their graduate capstone project. **All students must maintain a 3.3 grade point average on Lehigh's 4.0 scale. Students must submit their plan for completion of the Master's Degree as soon as possible after they have completed 15 credits toward their degree.**

The MA requires the successful completion of 30 hours of course work that must include: Historical Research (HIST 401) (3 credits); three different iterations of Readings in Transnational History (HIST 403) (9 credits); four or five elective graduate-level courses (12-15 credits); and an MA Capstone Project: Master's Essay, Master's Field Examination, MA Portfolio (all 3 credits), or MA Thesis (3-6 credits).

HIST 401	Historical Research	3
HIST 403	Readings in Transnational History [1]	9
HIST Grad Electives		12-15
MA Capstone [2]		3-6
Total Credits		**30**

1

3 different iterations of Readings in Transnational History (HIST 403) for a total of 9 credits are required.

2

MA Capstone Project may include a Master's Essay, Master's Field Examination, Master's Portfolio, or Master's Thesis for a total of 3-6 credits.

DOCTOR OF PHILOSOPHY

Students in the Ph.D. program in history must maintain a 3.5 average after two semesters of study. During the second semester, doctoral students select one major and two minor fields in which to take comprehensive written and oral examinations. No professor may direct more than one field, but the direction of a field may involve two professors. The dissertation will be in the major field. The dissertation advisor will chair a special committee that will oversee the student's graduate program. The other members of the special committee will be determined by the student in consultation with the major advisor, and must include at least one faculty member from another department or from outside of Lehigh University. An original dissertation is required, and it must be successfully defended to the examining committee. All Ph.D. students must meet the University Concentrated Learning Requirement. They must take Historical Research (401), and must take at least 18 hours of directed readings courses (400 series) beyond the M.A. The student's dissertation committee determines whether proficiency in a foreign language or proficiency in quantitative methods will be required for the doctoral degree.

Admission to the PhD. program is not automatic for students who complete the MA at Lehigh. Prospective PhD. students are encouraged to identify specific fields of interest and faculty members with whom they would like to work. At the PhD. level, students may consider department strengths in the following areas:

- African and Atlantic African-Diaspora History
- Latin American and Caribbean History
- British, French and Spanish Atlantic World Empires
- Early Modern and Modern European Intellectual History
- Holocaust, Genocide, Human Rights and Refugee Studies
- Ottoman Empire and Islamic World History
- Modern Chinese History
- Colonial America and Early American Republic
- Native American History
- Gender History
- 20th century US History
- African-American History

Students applying for the PhD. program should consult the list of faculty bios (https://history.cas2.lehigh.edu/faculty/) to learn more about these research specialties to help determine their compatibility with potential mentors. Not all fields may be accessible in a given year, given faculty leaves and mentoring duties. Applicants should contact faculty members directly if they have questions about the possibility of working on a related research field, or they may contact the Graduate Director, Prof. Nitzan Lebovic at nil210@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/history/nil210@lehigh.edu) with any questions about this process.

HIST 401	Historical Research	
HIST 400-level Coursework [1, 2, 3]		
HIST 499	Dissertation	
Total Credits [4]		**42-72**

1

Two different iterations of Readings in Transnational History (HIST 403).

2

Students may take up to two Independent Study (HIST 492) courses per semester.

3

The student's dissertation committee determines whether proficiency in a foreign language or proficiency in quantitative methods will be required for the doctoral degree.

4

Credit requirements for the program may vary. Students joining the program without an M.A. are required to complete 72 credits. Students with an M.A. from Lehigh are required to complete 42 credits, while students with an M.A. from another University are required to complete to 48 credits.

Major Fields

Major fields are Technology, Modern Britain, Colonial America, Nineteenth Century United States, Twentieth Century United States. (The Nineteenth and Twentieth century fields may be divided topically rather than chronologically; for example, a Student may be examined in labor/social history 1800-present, and in political history 1800-present.)

Minor Fields

Any of the major fields listed above may also be minor fields. Examples of other minor fields are American Studies; Ancient History; Early Modern Europe; Modern Europe; Latin America; Environmental History; Japan; Public History; Science, Technology and Society studies.

Language Requirements

The student's dissertation committee determines whether proficiency in a foreign language or proficiency in statistical methods will be required for the doctoral degree.

UNDERGRADUATE COURSES IN HISTORY

Petitions are required for first-year students to take 100-level or higher courses, and for sophomores to take 200-level or higher courses. HU fills humanities distribution requirements; SS fills social science requirements; ND not designated.

FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS

Graduate students may take 300 level courses, for which they receive 3 credits. Undergraduates must take them for 4 credits.

Courses

HIST 001 Time Travel: How to Make History 4 Credits
Students discover the power of historical analysis in a rapidly changing world by investigating a series of pressing contemporary problems. History emerges as a vital tool for confronting human diversity and understanding how societies are transformed. Skills acquired include causal analysis, empathy, interpretation, source criticism, information management, digital methods, public engagement, and argumentative writing. Themes addressed vary with instructor.
Attribute/Distribution: CC, HE, HU, Q, SS, SW, W

HIST 005 (AAS 005) African Civilization 4 Credits
SubSaharan Africa through the millennia of the ancient world to the present. Human origins, state and nonstate systems, the external slave trade, colonialism, resistance to European rule, independence movements, and neocolonialism.
Attribute/Distribution: CC, HE, SS, W

HIST 007 Technology in America's Industrial Age 4 Credits
Traces the development of American technology from the preindustrial colonial era until America's emergence as the world's leading industrial power. The interactions between technology and culture, society, politics, and the economy will also be addressed.
Attribute/Distribution: CC, SS, SW

HIST 008 Technology in Modern America 4 Credits
Traces the evolution of modern American technology, including automobiles, aircraft, computers, nuclear weapons, television, space, pharmaceuticals, and biotechnology.Includes critiques of technology such as environmentalism. The interactions of technology and culture, society, politics, and the economy will also be addressed.
Attribute/Distribution: CC, SS, SW

HIST 012 Inventing the Modern World: Europe in Global Perspective, 1648-present 4 Credits
The rise of modern nation states; the scientific and industrial revolutions; social movements and the French and Russian revolutions; impact of Enlightenment philosophy, nationalism, liberalism, imperialism and fascism; the development of modern class structure and transformations in gender relations, art, popular culture and society.
Attribute/Distribution: CC, HE, HU

HIST 015 (GS 015) Three English Revolutions 4 Credits
The Protestant Reformation, the Civil Wars, and the Glorious Revolution, from Henry the Eighth to John Locke. Examines how three bloody conflicts gave birth to the first modern society. Explores the origins of empire, capitalism, secularization, nationalism, and democracy.
Attribute/Distribution: CC, HE, HU, Q

HIST 017 (GS 017) Democracy's Rise and Fall 4 Credits
The promise and perils of democracy from the ancient world to the present.
Attribute/Distribution: CC, SS, SW, W

HIST 021 (CLSS 021) Greek History 4 Credits
The development of civilization from paleolithic times to the world empire of Alexander the Great.The social, economic, religious, philosophic, artistic, and literary development of the ancient world; the origin of political institutions.
Attribute/Distribution: SS

HIST 022 (CLSS 022) Roman History 4 Credits
Rome from its origins to A.D. 476.Political, social and religious developments.Transformation of the late Roman Empire to the early medieval period.
Attribute/Distribution: CC, HE, SS

HIST 025 Pirates of the Caribbean and Other Rogues of the Atlantic World 4 Credits
Introduction to the history of the Atlantic World, through the lens of piracy and seafaring. Interactions between Europe, Africa, and North and South America, 1442-1825.
Attribute/Distribution: CC, HE, SS, W

HIST 026 The Wild, Wild West 4 Credits
Introduction to the American West as both region and process. Investigates the diverse populations living in the West, including Native Americans, Mexicans, African Americans, Chinese, and Euro-American settlers, miners, and cowboys. Explores the process of first Spanish/Mexican, French, Russian, and then Anglo-American expansion, as well as the rise of the myth of the Wild West. Themes include the evolution of land use, immigration, labor, social communities, cultural life, environment, and changing technologies.
Attribute/Distribution: CC, SS, W

HIST 031 (JST 031) Empire, War, and Resistance in the Middle East 4 Credits
Over the past 200 years, empires have fought over the control of strategic trade routes and natural resources in the Middle East. Conflicts in Israel-Palestine, Iraq, and Syria emerged with the redrawing of borders. These geo-political changes shed light on how national identities changed but also on how Middle Eastern men and women resisted foreign occupation and domestic dictators alike. Through diverse media such as fiction, photography, and film, this course introduces students to the region’s rich history and legacy.
Attribute/Distribution: CC, HE, SS, W

HIST 041 The Making and Breaking of the United States 4 Credits
Native American cultures; European settlement; development of slavery and free labor systems; the Revolution; founding of the new nation; 19th century social, economic, cultural, and political development; Civil War.
Attribute/Distribution: CC, HE, SS, W

HIST 042 Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941 4 Credits
America's transformation into an industrial and global power from Reconstruction after the Civil War to the Great Depression; includes social, political, and cultural developments.
Attribute/Distribution: HE, SS

HIST 043 The United States Since 1941 4 Credits
World War II; Cold War at home and abroad; Civil Rights movement; the 1960s: Vietnam, the welfare state and social upheavals; new forms of cultural expression; feminism; rise of neoconservatism.
Attribute/Distribution: CC, HE, SS, W

HIST 049 (GS 049, LAS 049) The True Road to El Dorado: Colonial Latin America 4 Credits
Examines the initial encounters of peoples of Iberian and African origins with the indigenous civilizations of the Western Hemisphere. Explores the development of a colonial economy and its global reach. Focuses on the birth of a distinctive Latin American society and culture, with attention to the Latin American patriots who fought for their freedom. No prior knowledge of Latin American history required.
Attribute/Distribution: CC, SS, SW, W

HIST 050 (GS 050, LAS 050) Heroes, Dictators, and Revolutionaries: Latin America since Independence 4 Credits
Examines the 200-year-long struggle of Latin American peoples to gain political representation, economic equality, and social justice. Explores key historical events in Latin America from the movement for independence in the early nineteenth century to today's modern societies. Topics include the wars of independence, the rule of caudillos, foreign military interventions, export economies, populism, social revolutions, the Cold War era, state terror and military dictatorships, and the war on drugs.
Attribute/Distribution: CC, SS, SW, W

HIST 075 (ASIA 075, MLL 075) Chinese Civilization 4 Credits
This course reviews the evolution of Chinese culture from the Neolithic up to the end of the imperial age in 1911. While the framework is historical, students are exposed to all facets of what defines civilization, including social traditions, philosophy, religion, material culture, literature, art and architecture, military science, education, law, and institutional history. Students are encouraged to continue their study of China afterwards with the course on Modern Chinese Civilization.
Attribute/Distribution: CC, HE, HU, SS, W

HIST 080 (ASIA 080) In Search for Modern China 4 Credits
This course is designed as a survey history of modern China from the late Ming to the present. We will ask some important questions over the course of the semester. When does "modern" China begin? How do we approach modern Chinese history? What are the boundaries of China/Chinese identity? Could these concepts stretch to include the Chinese diaspora? How has Chinese imperial history affected contemporary China’s state and society?
Attribute/Distribution: CC, HE, SS, W

HIST 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, Q, SS, SW, W

HIST 101 (GS 101) Histories of Globalization 4 Credits
Critical historical perspectives on current debates around “globalization” and the varied paths and responses to modernity, using recent scholarship associated with the New Global History. The “Rise of the West” paradigm, Industrial Revolution and modernization theory; creation of global financial markets, nationbuilding and New Imperialism; Great Depression and World Wars as global historical events; postwar decolonization, Cold War and emergence of North-South relations; impact of consumerism, movements for women's rights, ethnic nationalism and religious fundamentalist movements in traditionbound societies.
Attribute/Distribution: CC, HE, HU

HIST 105 Sports in Modern America 4 Credits
Surveys the social, cultural, and political role of sports in America since the Civil War. By addressing the development of sports and its relationship with race, class, ethnicity, gender, the media, popular culture, and government, this class will examine the impact of sports in making the America and Americans of the 20th century.
Attribute/Distribution: HE, HU

HIST 107 (GS 107) Science and Technology in the Making of the Modern World 4 Credits
This course covers world history from 1400, focusing on the rise of science, with important and wide-ranging implications for the modem world and the society we live in today. Global travel, exploration, trade, and technological innovations played essential roles in the exchange of knowledge and the development and rise of modem science. Science and technology have also contributed to the growing disparities in the modem world.
Attribute/Distribution: SS, SW, W

HIST 110 American Military History 4 Credits
The American military tradition from colonial times to the present.America's wars and the development and operation of military institutions within the political, economic, ideological, and technological milieu of American society.
Attribute/Distribution: SS, SW

HIST 112 Takin’ It to the Streets: The Global Sixties 4 Credits
Welcome to the Days of Hope and Rage. The Global Sixties explores a watershed decade of unprecedented political activism and backlash, focusing on social movements (free speech, students, civil rights/Black Power, feminisms, environmentalism), national liberation struggles, and global counterculture. We examine the ideologies, tactics, and meanings of 1960s movement culture and new subcultures related to Rock n Roll, sexual freedom, and illicit drugs. Course materials include the stuff of the 60s, including visual, textual, and audio sources.
Attribute/Distribution: HE, HU

HIST 118 (HMS 118) History of Modern Medicine 4 Credits
Introduction to Western medical history from the 18th century to the present day. Students will explore patient/practitioner relationships, examine changing ideas concerning health, sickness, and disease, chart changes in hospital care and medical education, and tackle topics such as eugenics, medical experimentation, and health insurance.
Attribute/Distribution: HE, HU

HIST 120 Revolutionary America 4 Credits
Origins and development of the American republic from 1750 through the adoption of the Federal Constitution.
Attribute/Distribution: CC, HE, SS, W

HIST 121 From Alexander the Great to Cleopatra 4 Credits
This course covers the Hellenistic Period, from Alexander's conquests to Cleopatra's loss to Rome (4th-1st centuries BCE). We will learn about the Hellenistic empires in Greece, Asia Minor, Syria, and Egypt. In this course students will discuss how Greek culture spread throughout these parts of the world while incorporating local practices in the areas of art and architecture, religion, magic, and technology.
Attribute/Distribution: HE

HIST 124 (WGSS 124) Women and Gender in US History 4 Credits
Roles of women in American society from colonial to present times: attitudes toward women, female sexuality, women's work, and feminism.
Attribute/Distribution: CC, SS, SW, W

HIST 125 (HMS 125, WGSS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. The class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: CC, HE, HU, W

HIST 126 (AAS 126, WGSS 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women's historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: CC, HE, HU

HIST 130 (AAS 130) African American History 4 Credits
Blacks in America from the first importation of Africans to the implementation of civil rights laws. West African origins, slave trade, slavery, free blacks and emancipation and study of Reconstruction, segregation, urbanization, and the struggle for racial equality.
Attribute/Distribution: CC, HE, SS, W

HIST 131 (AAS 131, GS 131, WGSS 131) Women, Gender, Sexuality and Race in African Societies 4 Credits
This course explores the various ways in which womanhood, gender, sexuality and race are defined, constructed and articulated in African societies. The interdisciplinary course draws from historical writings, novels, biography, anthropology, political science, health and other fields to examine diverse activities and contributions of African women from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

HIST 134 (AAS 134) History and Cultures of Ghana 4 Credits
Overview of Ghana's history and cultures from the fifteenth century, examining diversity among various ethnic groups and covering such themes as religion, literature, art, music/dance, gender, family and anti-colonial movements. The course will also explore how slave castles/forts contributed to the transatlantic slave trade, Pan-Africanism and global tourism.
Attribute/Distribution: CC, HE, HU, W

HIST 135 Era of Jefferson and Jackson 4 Credits
Colonial beginnings; the Articles of Confederation and the Constitution; the creation of a new nation; the development of American political parties; the antebellum American state.
Attribute/Distribution: CC, HE, SS, W

HIST 136 Era of the Civil War and Reconstruction 4 Credits
American abolitionism and the origins of the Civil War; the Second American Revolution; Reconstruction and its sequel.
Attribute/Distribution: CC, HE, SS, W

HIST 137 Coming to America: U.S. Immigration History 4 Credits
This course addresses the historical roots of current-day debates in the United States over immigration, deportation, borders, refugee admissions, and the boundaries of inclusion and exclusion in the nation. It considers how immigration patterns and policies have reflected evolving ideas about race, gender, labor, sexuality, health, and political ideology. Using historical scholarship, government documents, film, and literature we will discuss citizenship, nativism, assimilation, the development of ethnic communities, and immigrant rights activism from the colonial period through the present.
Attribute/Distribution: CC, HE, HU, W

HIST 149 (LAS 149) Narcos: The Global Drug Wars 4 Credits
Tobacco, sugar, coffee, opium, marijuana, cocaine. From Columbus's encounter with the New World to the rise and demise of Pablo Escobar and "El Chapo" Guzmán, drugs have been coveted global commodities. Through readings, discussions, and films, this course examines the history of drug production, drug trafficking, and the so-called "war on drugs" in Latin America.
Attribute/Distribution: CC, SS, SW, W

HIST 150 Medieval Civilization 4 Credits
Formation and development of western culture to about 1400. Rise of universities and towns, legal development and origins of representative government, origins of nationstates, scholasticism and decline of the medieval church.
Attribute/Distribution: CC, HE, HU

HIST 154 (JST 154, REL 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust.
Attribute/Distribution: CC, HE, HU, W

HIST 175 (GS 175, JST 175, REL 175) History of Racism, anti-Semitism, and Islamophobia 4 Credits
From the history of slavery in the ancient world to Charlottesville 2017. We will read texts and watch movies that discuss the history of slavery, anti-Semitism, and Islamophobia. The historical meeting of worlds goes from "social slavery" in the ancient world to the "blood laws" in medieval Spain; colonialism in the New World, the rise of biological racism in the nineteenth century, and of cultural racism in the twentieth century.
Attribute/Distribution: CC, HE, SS, W

HIST 176 (AAS 176, GS 176, HMS 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students' final papers will perform a "post-mortem" on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: CC, HE, HU, W

HIST 178 (AAS 178, GS 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: CC, HE, SS, W

HIST 179 (AAS 179) Black Political Thought in America 4 Credits
Black leadership, organizations, and philosophy in America from Reconstruction to the Civil Rights Era; ideas and programs of Booker T. Washington, W.E.B. DuBois, Marcus Garvey, Malcolm X and Martin Luther King, Jr.
Attribute/Distribution: HE, SS

HIST 180 (REL 180) Religion and the American Experience 4 Credits
The historical development of major religious groups in this country from colonial times to the present.Their place in social and political life, and the impact of the national experience upon them.Emphasis on religious freedom and pluralism, and the churchstate relationship.
Attribute/Distribution: HE, HU, W

HIST 183 (ART 183, GS 183) France from Medieval to Modern:Soc., Pol. & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: CC, HE, HU

HIST 184 (ARCH 184, GS 184) Paris: The Global City 3 Credits
An overview of the development of the city of Paris from its origins as an outpost on the far reaches of the Roman Empire to its rise as capital of medieval Christendom, from seat of Absolute Monarchy to birthplace of modern revolutions, resistance and occupation in the era of world wars, and model of modern urban planning in the 19th, 20th and 21st centuries. Focus is on the way global contexts shaped social and political life at the local level.
Attribute/Distribution: CC, HE, HU

HIST 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, Q, SS, SW, W

HIST 256 (ASIA 256, MLL 256, WGSS 256) Women in Pre-Industrial China 4 Credits
This seminar focuses on the role of women as defined by medical, philosophical, legal, historical, religious, literary and other Chinese texts from ancient through early modern times. Attention is how women contributed to the evolution of traditional Chinese civilization and culture. The course materials are in English.
Attribute/Distribution: HE, HU, W

HIST 257 (ASIA 257, HMS 257, MLL 257) Traditional Chinese Medicine: Historical Perspectives 4 Credits
This seminar focuses on conceptions of the human body and health that evolved from the ancient through early modern times. Special attention is paid to healing strategies, the roles of healers and patients, and the evolution of a medical canon. The course materials are in English.
Attribute/Distribution: HE, HU, W

HIST 300 Apprentice Teaching 3 Credits
Attribute/Distribution: ND

HIST 302 The Capstone Experience 4 Credits
Culmination of the major. Working collectively on a broadly-defined theme, students master the tools of historical inquiry by developing and completing individual research projects that engage primary and secondary sources. Theme varies with instructor. Departmental permission required.
Prerequisites: HIST 001
Can be taken Concurrently: HIST 001
Attribute/Distribution: CC, HU, Q, SS, W

HIST 305 Public History 3-4 Credits
An examination of the public role of history in modern society, with focus on issues facing historians in museums, historical societies, archives, historic preservation, the federal government, and other organizations in the public sphere.
Attribute/Distribution: HE, SS

HIST 306 Internship in Public History 2-4 Credits
Professionally supervised work in a museum, historical society, archive, or other historical agency. Written journal or report evaluating the experience is required. Permission of department chair required. May be repeated for a maximum of six credits. May not be counted toward the major requirement of 12 hours of courses numbered 303 or higher.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE

HIST 315 (EVST 315) American Environmental History 4 Credits
Relationship between Americans and their natural environment from the colonial period to the present: impact of European settlement, attitudes toward wilderness, role of technological development, rise of preservation and conservation movements, establishment of national parks, recent environmental protection legislation.
Attribute/Distribution: CC, HE, SS

HIST 319 Colonial America 3,4 Credits
Founding and growth of colonies in North America through 1763. Emphasis on motives for settlement, Native American-European relations, and the economic, social, and political development of the British West Indies, and mainland provinces.
Attribute/Distribution: CC, SS, SW, W

HIST 320 History of North American Indians 3,4 Credits
The history of American Indians from before European contact to the present. Emphasis will be placed on the diversity of native peoples of eastern North America and how patterns of interaction between native Americans and Euro-Americans have changed over time. Discussion format, research paper.
Attribute/Distribution: CC, SS, SW, W

HIST 322 (AAS 322, WGSS 322) African Women, Voices and Lives 3-4 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

HIST 325 (SOC 325, WGSS 325) History of Sexuality and the Family in the U.S. 3-4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the postWorld War II era.Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.
Attribute/Distribution: CC, SS, SW, W

HIST 330 (AAS 330) Africans and the Atlantic World 3-4 Credits
This course chronicles the history of Africans and the Atlantic world from the fifteenth century. It explores cross-cultural interactions and exchanges between Africans and Europeans and covers major themes including trade, religion, slavery, abolition, identity, colonialism, gender, the "Back-to-Africa" movements and impact of Africans on Atlantic world history.
Attribute/Distribution: CC, HE, HU, W

HIST 331 (AAS 331) United States and Africa 3,4 Credits
Reciprocal relationships between North America and the African continent from the slave trade in the 17th century to the 20th century-Afrocentric movement; impact of Americans on the shaping of modern Africa, Pan-African relations; influence of African Americans on US policies toward Africa.
Attribute/Distribution: CC, HE, SS, W

HIST 332 (AAS 332) Slavery and the American South 3-4 Credits
The emergence and demise of the “peculiar institution” of African American slavery in British North America and the Old South. African background; colonial beginnings; 19th century-slave community; the ruling race and proslavery ideology; the death of slavery and its aftermath; slavery and freedom in a comparative context.
Attribute/Distribution: HE, SS

HIST 336 Bethlehem and the Lehigh Valley 3-4 Credits
Local history focusing on Native American communities, Moravian settlement, natural resources, industrial firms, immigration and ethnic communities, organized labor, housing patterns and urban sprawl, high-tech industry, and tourism. Includes an analysis of techniques used in presenting these topics to the public.
Attribute/Distribution: CC, HE, SS

HIST 341 (AAS 341, GS 341) Global Africa: Aid, Volunteerism, NGO's and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: CC, HE, SS, W

HIST 347 (GS 347) The French Revolution and Napoleon: A Global History 3,4 Credits
Global origins; breakdown of Absolute Monarchy; rise of Enlightenment culture and decadence of the court; storming of the Bastille and creation of republican government; invention of modern nationalism and Napoleonic military culture; women in political life; uses of mass propaganda, public festivals and transformation of the arts; political violence in the “Terror”; abolition of slavery and origins of Haitian Revolution; Napoleon's imperial system and warfare with Europe; impact on global imperial rivalries and revolutionary movements abroad.
Attribute/Distribution: CC, HE, HU, W

HIST 348 (GS 348) The British Empire and the Modern World 3-4 Credits
Examines the empire and its central role in the process of globalization between the 16th and 20th centuries. Topics include exploration, state-building, war, multinational corporations, industry, international finance, missionaries, racism, and independence movements.
Attribute/Distribution: CC, SW, W

HIST 350 19th Century Paris and the Invention of Modernity 3,4 Credits
This course considers the dramatic destruction and rebuilding of the city of Paris in the decades after 1850 and how changes in the built environment shaped social relations, political authority and cultural expression. Topics include the politics of city planning and architectural design; the history of the engineering profession, technology and the building trades; reactions to crime, disease and prostitution in the modern city; the 1848 Revolution, Paris Commune and political theory; the origins of photography, Impressionist painting and cinema;.
Attribute/Distribution: CC, HE, HU

HIST 352 History of Total War 3-4 Credits
This seminar examines the gradual rise of the idea of total war from the religious and civil wars of the 17th century, through the French Revolution, the Napoleonic War, the American Civil War, the two World Wars, the Cold War, and The War on Terror. We will examine the difference between war as political means and modern warfare as the very ends of politics, religion, and culture.
Attribute/Distribution: CC, HE, HU, W

HIST 354 History of Global Fascism 3-4 Credits
This course examines the historical and philosophical roots of European right-wing extremism, such as Italian and French Fascism, German Nazism, Austro-Hungarian Conservative Revolution, and other forms of radical nationalism.
Attribute/Distribution: CC, HE, HU, W

HIST 356 European Cultural History 3,4 Credits
Transformation of European culture from the 18th century to the present. The Enlightenment, cultural impact of the French and industrial revolutions, romanticism and ideologies of the 19th century, contemporary European thought.
Attribute/Distribution: CC, HE, HU, W

HIST 360 American Legal History 3,4 Credits
The interrelationship between law and social development with emphasis on modern period.Founding of constitutional government and balance of power within the federal system, the problem of slavery, legal support and regulation of business, and the use of law in various reform and civil rights movements.
Attribute/Distribution: SS, SW

HIST 367 Rise and Fall of the Old South 3,4 Credits
Explores the American South as a region from the era before European contact to the end of the Civil War. Emphasis will be placed on exploration and settlement, Native American-European relations, the pre-Revolutionarry contest for empire, and the rise and development of the plantation complex and slavery.
Attribute/Distribution: CC, HE, SS, W

HIST 368 Seminar in Latin American History 3,4 Credits
Readings and individual investigation of selected topics.
Attribute/Distribution: SS, SW

HIST 369 (LAS 369) Columbus on Trial: A Critical Reading of the Spanish Conquest 4 Credits
In this seminar students master the history of the Conquest era (roughly, 1490s-1570s) in Spanish America and learn about the origins of colonialism. The course offers an opportunity to read critically some traditional European-centered narratives of the Conquest. It also incorporates the views and voices of Indigenous peoples and Africans. After reading classic primary and secondary sources, students judge for themselves the complex and rather tragic legacy of the encounter between Europeans and the Indigenous peoples of the Americas.
Attribute/Distribution: CC, HE, HU, W

HIST 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, Q, SS, SW, W

HIST 392 Independent Study 1-4 Credits
Directed readings in a topic or area of history not covered by current course offerings. For students of demonstrated ability and adequate preparation. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, Q, SW, W

HIST 393 Honors Thesis in History 4 Credits
Opportunity for undergraduate majors in history to pursue an extended project for senior honors. By department permission only.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, Q, W

HIST 394 Honors Thesis in History 4 Credits
Continuation of History 393. By department permission only.
Repeat Status: Course may be repeated.
Prerequisites: HIST 393
Attribute/Distribution: CC, Q, W

HIST 401 Historical Research 3 Credits
Techniques of research in history: training in the critical handling of documentary materials, in measuring the value of evidence, and in formal presentation of the results of research. Students will write an original research paper using primary materials. Required of all graduate students in history.

HIST 402 Public History 3 Credits
An examination of the public role of history in modern society, with focus on issues facing historians in museums, historical societies, archives, historic preservation, the federal government, and other organizations in the public sphere.

HIST 403 Readings in Transnational History 3 Credits
Required readings seminar for MA and PhD students exploring methods and examples of Transnational scholarship; specific theme, period, and geographic area varies according to the semester and faculty member teaching the course.
Repeat Status: Course may be repeated.

HIST 404 Readings in the History of the Atlantic World, 1500-1900 3 Credits
Core readings offering a comparative and integrative approach to studying the development of nations, economic systems and trade, colonization, and cultural encounters among the people of Europe, Africa, and the Americas.

HIST 405 Readings in the History of Industrial America 3 Credits
Core readings in the history of technology and the larger framework of intellectual, social, economic, and political history. Includes comparative studies in the history of industrializing Europe and Japan.

HIST 412 Readings in the American Revolutionary Era 3 Credits
Study in small groups under the guidance of a faculty member on the historiography of the era of the American Revolution.
Repeat Status: Course may be repeated.

HIST 415 American Environmental History 3 Credits
Relationship between Americans and their natural environment from the colonial period to the present: impact of European settlement, attitudes toward wilderness, role of technological development, rise of preservation an conservation movements, establishment of national parks, recent environmental protection legislation.

HIST 419 Colonial America 3 Credits
Founding and growth of colonies in North America through 1763. Emphasis on motives for settlement, Native American-European relations, and the economic, social, and political development of the British West Indies, and mainland provinces.

HIST 420 History of North American Indians 3 Credits
The history of American Indians from before European contact to the present. Emphasis will be placed on the diversity of native peoples of eastern North America and how patterns of interaction between native Americans and Euro-Americans have changed over time. Discussion format, research paper.

HIST 421 Readings in Topics in the Atlantic World 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in the history of the Atlantic World.
Repeat Status: Course may be repeated.

HIST 422 (AAS 422, WGSS 422) African Women, Voices and Lives 3 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.

HIST 425 History of Sexuality and Family in the United States 3 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post World War II era. Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.

HIST 426 Readings in Topics in American History 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in U.S. history across several centuries.
Repeat Status: Course may be repeated.

HIST 430 Africans and the Atlantic World 3 Credits
This course chronicles the history of Africans and the Atlantic world from the fifteenth century. It explores cross-cultural interactions and exchanges between Africans and Europeans and covers major themes including trade, religion, slavery, abolition, identity, colonialism, gender, the "Back-to-Africa" movements and impact of Africans on Atlantic world history.

HIST 431 United States and Africa 3 Credits
Reciprocal relationships between North America and the African continent from the slave trade in the 17th century to the 20th century-Afrocentric movement; impact of Americans on the shaping of modern Africa, Pan-African relations; influence of African Americans on US policies toward Africa.

HIST 432 Global Africa: Aid, Volunteerism, NGO's and International Studies 3 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.

HIST 433 History of Total War 3 Credits
This seminar examines the gradual rise of the idea of total war from the religious and civil wars of the 17th century, through the French Revolution, the Napoleonic War, the American Civil War, the two World Wars, the Cold War, and The War on Terror. We will examine the difference between war as political means and modern warfare as the very ends of politics, religion, and culture.

HIST 434 History of Fascism 3 Credits
This course examines the historical and philosophical roots of European right-wing extremism, such as Italian and French Fascism, German Nazism, Austro-Hungarian Conservative Revolution, and other forms of radical nationalism.

HIST 436 Bethlehem and the Lehigh Valley 3 Credits
Local history focusing on Native American communities, Moravian settlement, natural resources, industrial firms, immigration and ethnic communities, organized labor, housing patterns and urban sprawl, high-tech industry, and tourism. Includes an analysis of techniques used in presenting these topics to the public.

HIST 440 Readings in Colonial American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 17th and 18th centuries.
Repeat Status: Course may be repeated.

HIST 441 Readings in Nineteenth Century American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 19th century.
Repeat Status: Course may be repeated.

HIST 442 Readings in Twentieth Century American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 20th century.
Repeat Status: Course may be repeated.

HIST 443 Readings in English History 3 Credits
Study in small groups, under the guidance of a faculty member, of the literature of a particular period, problem, or area of English history.
Repeat Status: Course may be repeated.

HIST 444 Readings in Latin American History 3 Credits
Study in small groups, under the guidance of a faculty member, of the literature of a particular period, problem, or area of Latin American history.
Repeat Status: Course may be repeated.

HIST 445 Readings in the History of Science 3 Credits
Study in small groups under the guidance of a faculty member on the history of science.
Repeat Status: Course may be repeated.

HIST 446 Readings in the History of Technology 3 Credits
Study in small groups under the guidance of a faculty member of the history of technology.
Repeat Status: Course may be repeated.

HIST 447 The French Revolution and Napoleon: A Global History 3 Credits
Global origins; breakdown of Absolute Monarchy; rise of Enlightenment culture and decadence of the court; storming of the Bastille and creation of republican government; invention of modern nationalism and Napoleonic military culture; women in political life; uses of mass propaganda, public festivals and transformation of the arts; political violence in the “Terror”; abolition of slavery and origins of Haitian Revolution; Napoleon's imperial system and warfare with Europe; impact on global imperial rivalries and revolutionary movements abroad.

HIST 448 (POLS 448) Land Use, Growth Management, and the Politics of Sprawl 3 Credits
Introduction to issues of Land Use Planning, Community, Growth Management, and Sprawl. Examination of history of urban development in America from earliest settlements to the auto suburbs; also such planning and development factors as comprehensive plans, zoning, and the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, and comparisons to development patterns in other countries.

HIST 449 The British Empire and the Modern World 3 Credits
Examines the empire and its central role in the process of globalization between the 16th and 20th centuries. Topics include exploration, state-building, war, multinational corporations, industry, international finance, missionaries, racism, and independence movements.

HIST 450 19th Century Paris and the Invention of Modernity 3 Credits
This course considers the dramatic destruction and rebuilding of the city of Paris in the decades after 1850 and how changes in the built environment shaped social relations, political authority and cultural expression. Topics include the politics of city planning and architectural design; the history of the engineering profession, technology and the building trades; reactions to crime, disease and prostitution in the modern city; the 1848 Revolution, Paris Commune and political theory; the origins of photography, Impressionist painting and cinema.

HIST 451 Readings in Topics in Amercian History 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in U.S. history across several centuries. May be repeated for credit with permission of the instructor.
Repeat Status: Course may be repeated.

HIST 452 Research in American History 3 Credits
An intensive research seminar on a phase of American history.
Repeat Status: Course may be repeated.

HIST 453 Research in English History 3 Credits
An intensive research seminar on a phase of English history.
Repeat Status: Course may be repeated.

HIST 454 History of Global Fascism 3 Credits
This course examines the historical and philosophical roots of European right-wing extremism, such as Italian and French Fascism,German Nazism, Austro-Hungarian Conservative Revolution, and other forms of radical nationalism.

HIST 455 Research in History of Science and Technology 3 Credits
An intensive research seminar on a phase or aspect of the history of science and technology.
Repeat Status: Course may be repeated.

HIST 456 European Cultural History 3 Credits
Transformation of European culture from the 18th century to the present. The Enlightenment, cultural impact of the French and industrial revolutions, romanticism and ideologies of the 19th century, contemporary European thought.

HIST 457 Research in European History 3 Credits
An intensive research seminar on a phase of European history.
Repeat Status: Course may be repeated.

HIST 458 (WGSS 458) Readings in Gender History 3 Credits
Study in small groups under the guidance of a faculty member on the literature of an issue, period, country or culture within gender history.
Repeat Status: Course may be repeated.

HIST 467 Rise and Fall of the Old South 3 Credits
Explores the American South as a region from the era before European contact to the end of the Civil War. Emphasis will be placed on exploration and settlement, Native American-European relations, the pre-Revolutionarry contest for empire, and the rise and development of the plantation complex and slavery.

HIST 469 Columbus on Trial: A Critical Reading of the Spanish Conquest 3 Credits
In this seminar students master the history of the Conquest era (roughly, 1490s-1570s) in Spanish America and learn about the origins of colonialism. The course offers an opportunity to read critically some traditional European-centered narratives of the Conquest. It also incorporates the views and voices of Indigenous peoples and Africans. After reading classic primary and secondary sources, students judge for themselves the complex and rather tragic legacy of the encounter between Europeans and the Indigenous peoples of the Americas.

HIST 490 Thesis 1-6 Credits

HIST 491 Special Topics 1-3 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.

HIST 492 Independent Study 1-3 Credits
Individual study under the direction of a faculty member of a topic in history.
Repeat Status: Course may be repeated.

HIST 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

International Relations

Today's world is more interconnected than ever before: what happens “here” affects what happens “there” and vice versa. The economic fortunes of countries, firms, and individuals have become so sensitive to trade, monetary, and investment decisions made elsewhere that economic policy that is purely national has become all but impossible. Nuclear weapons, which can kill thousands in minutes, do not respect international boundaries; neither do the consequences of ethnic and communal conflicts. Non-state actors, from terrorists to human rights activists, also act across boundaries. The Internet has made it easier than ever to form networks and political movements that span borders. Climate everywhere is affected by environmental decisions anywhere. In the 21st century, no state – not even the United States, though it has become the first sole superpower in the history of the modern international system– and no citizen can make important choices in a sound manner without understanding how their decisions are shaped by what happens outside the boundaries of their homeland; moreover, their decisions often affect people who live far beyond those borders.

International Relations (IR) is the study of world politics in all of its aspects: International security covers issues related to war and peace, among and within societies. International political economy focuses on the political dimensions of trade, investment, development, and poverty. International law, organizations, and ethics and norms involve the study of how legal principles and agreements and moral values contribute to the creation of order, create the basis for stable expectations, and regulate transactions among states and other participants in world affairs. IR theory exposes students to the major explanatory frameworks that have been developed for the study of international relations.

IR investigates the gamut of economic, technological, social, and cultural and military forces that create the increasing interdependence that we call “globalization.” IR examines the ways in which globalization and other factors have sometimes contributed to the creation of order but also often to the breakdown of order, violence among and within states, and to assertions of particularity, whether based on ethnicity, nationalism, or on differences in culture, or wealth. Much of IR is devoted to explaining the behavior of states, but IR also encompasses many entities besides sovereign states. These include international organizations (such as the United Nations and its affiliated organizations); nongovernmental organizations; and intergovernmental organizations, such as the World Trade Organization, the European Union, the African Union, or Mercosur, the Latin American trading bloc.

Lehigh University has one of the few Departments of International Relations in the United States. At Lehigh world, politics is not simply

a division of political science. The IR Department is, therefore, able to offer a concentrated and multifaceted program, and one that is truly interdisciplinary. Some IR faculty study world politics as scholars of particular geographic regions, others as theorists seeking to explain the major processes of world politics regardless of where and when they occur: for instance, the causes and consequences of different forms of warfare; the rise and decline of empires; the challenges posed by environmental degradation; and the forces that create both wealth and poverty. What we share is the dedication to teaching and scholarship and the commitment to encouraging our students to engage new ideas and to subject familiar ones to thorough scrutiny.

Judging by the number of students who choose IR as their major, it is one of the most popular disciplines at Lehigh. Moreover, as befits a field that cuts across so many disciplines, we draw students who also pursue coursework, minors, or “double majors” in fields ranging from Religion Studies, Modern Languages and Literatures, Economics, and History to Computer Science, Biology, Engineering, and Environmental Policy.

THE CURRICULUM

Students considering coursework in international relations are strongly encouraged to visit the International Relations website (http://ir.cas2.lehigh.edu (http://cas.lehigh.edu/ir/)). Prospective International Relations majors should enroll in IR 010 and ECO 001 as early as possible. We recommend that IR majors fulfill the mathematics portion of their college distribution requirement with MATH 012 (Basic Statistics), although this course is not required for the major.

DEPARTMENTAL HONORS

To graduate with Departmental Honors, a major in international relations must:

1. successfully complete a two-semester honors thesis (IR 388) in the senior year;
2. attain a GPA of at least 3.5 in the courses constituting the IR major program at the time of graduation. See the department website for additional information.

BEYOND THE IR CURRICULUM

In close cooperation with the international education office, the department assists students interested in study abroad programs. In addition, Lehigh has an array of summer programs, which involve coursework and/or internships in such countries as China, the Czech Republic, and the United Kingdom.

Every semester speakers with expertise on various aspects of world affairs visit Lehigh. Featured speakers have included Dr. Madeline Albright, former U.S. Ambassador to the United Nations; Dr. Shashi Tharoor, former U.N. Under-Secretary-General for Communications and Public Information; Dr. Ernesto Zedillo, former President of Mexico and Director of the Yale Center for the Study of Globalization; and General Anthony Zinni, 40 year Marine Corps veteran and U.S. peace envoy to the Middle East.

The student-run World Affairs Club sponsors a number of activities each year, including student-faculty socials, guest speakers, and related programs. In 2004, Lehigh became the 6th university in the world to gain Non-Governmental Organization (NGO) status with the United Nations. The University's unique partnership with the UN has allowed for many International Relations majors to serve as UN NGO Youth representatives over the years

The department has an active program in conjunction with Career Services to help place students in internships. We strongly encourage students to obtain an internship. Most of these internships are likely to be in New York or Washington, D.C.

UPON GRADUATING

While a degree in international relations does not lead to a specific career in the way that, for example, accounting or engineering does, a major in international relations, by emphasizing clarity in speech and writing, analytical skills, and a detailed knowledge of world politics prepares students for careers in international business, government, journalism, law, nongovernmental organizations, and teaching and research. Recent IR graduates currently work in all of these fields. Some have gone directly into careers upon graduating; others have enrolled in graduate school prior to employment.

MAJOR IN INTERNATIONAL RELATIONS

The major consists of eleven courses for a total of 40 credits, plus one collateral course. This is the minimum requirement, however, and we strongly urge students to enrich their educations by going further. The courses required are:

Collateral requirements		
ECO 001	Principles of Economics	4
Introductory courses		
IR 010	Introduction to World Politics	4
Core courses (4 courses, 16 credits)		**16**
IR 100	Methods and Research Design	
Select one course each from three of the following functional groups:		
Theory and Policy		
IR 205	Theories of International Relations	
IR 210	Foreign Policy	
International Political Economy		
IR 220	Globalization and World Politics	
IR 223	Work & Labor in a Global Economy	
IR 225	International Political Economy	
International Security Studies		
IR 234	Great Power Politics	
IR 235	International Security	
IR 236	Causes of War	
IR 237	National Security: The Military Instrument of Foreign Policy	
International Governance		
IR 245	International Organization	
Advanced courses		
Select any two IR courses numbered 300-387 (except IR 307) or IR 393		8
Electives		
Select any IR courses other than IR 002, IR 090, IR 388 or IR 391 (normally three 4-credit courses). [1]		12
Total Credits		**40**

1

Core or advanced courses beyond the minimum requirements may be counted as electives. Certain courses offered by other departments may also qualify. See the Department of International Relations for a complete list.

MINOR IN INTERNATIONAL RELATIONS

The minor consists of 16 credits:

IR 010	Introduction to World Politics	4
Select IR electives other than IR 002, IR 090 or IR 391 (normally two 4-credit courses).		8
Select one advanced IR elective numbered 300-387 (except IR 307) or IR 393		4
Total Credits		**16**

JOINT INTERNATIONAL RELATIONS AND ECONOMICS MAJOR

Please click here: Joint IR/Eco Major (p. 188)

JOINT INTERNATIONAL RELATIONS AND MODERN LANGUAGES AND LITERATURES MAJOR

Please click here: Joint IR/MLL Major (p. 188)

Courses

IR 002 Current Issues in World Affairs 3 Credits

This is a survey course designed primarily for non-IR majors or minors. The purpose is to acquaint students with some of the concepts and historical facts behind current global issues. The content of this course will, in part, be dictated by international events as they unfold.

Attribute/Distribution: CC, SS, SW

IR 010 Introduction to World Politics 4 Credits
Introduction to the major principles, concepts, and theories of international relations, along with a historical background focusing on the 19th and 20th centuries. Topics to be covered include the nature of power, balance of power theories, national interest, decision-making in foreign policy, theories of war and expansion, patterns of Cooperation, and international political economy.
Attribute/Distribution: CC, SS, SW

IR 011 International Relations in Popular Culture 4 Credits
International politics inspires all forms of cultural response, including novels, poetry, art, and film. These media are as or even more influential in shaping public views of international relations, and often policy, than is social science research. This course examine international politics through the artistic lens, juxtaposing artistic interpretations with social science explanations.
Attribute/Distribution: CC, HE, HU

IR 015 Authoritarianism 4 Credits
Authoritarianism has been the dominant form of government throughout history, and more than half of the world lives under it today. This course addresses its various forms and central dynamics. Learn how rulers organize coups, repress societal opposition, create cults of personality, enrich cronies, and avoid being overthrown by rivals. Use real-world case studies from the Mideast, Africa, Asia, Europe, and Latin America to find out how authoritarian regimes have dealt with technological change and Western democracy promotion.
Attribute/Distribution: CC, SS, SW

IR 026 Political Economy of Corruption I 4 Credits
This course examines causes and consequences of various forms of corruption from the political-economic perspective; helps students better understand various sources, types, patterns, and consequences of corruption; considers corruption that exists in both the public and private sectors; evaluates how corruption affects economic growth and resource allocation; and assesses global and national strategies to reduce corruption. Students may not receive credit for both IR 026 and IR 226.
Attribute/Distribution: CC, SS, SW

IR 030 The Nuclear Revolution 4 Credits
The invention of nuclear weapons has revolutionized international politics more profoundly than anything since the invention of agriculture. States can now destroy each other without defeating each other militarily or even if defeated themselves, leading to elaborate concerns about nuclear deterrence, nuclear proliferation, and custody of fissile material. Some credit nuclear deterrence with making the Cold War into the Long Peace. This course explores these and related questions, including whether we can expect the Long Peace to continue.
Attribute/Distribution: CC, SS, SW

IR 034 Society, Technology and War 4 Credits
This course explores the links between war and society in both directions: the impact of social, economic, and technological change on how wars are fought and the purposes for which they can be fought; as well as the impact of war mobilization needs and of war itself on how societies develop, including the rise of capitalism, democratization, economic planning and other modern institutions, and emancipation of disadvantaged groups in society, such as blacks and women in the United States.
Attribute/Distribution: SS, SW

IR 036 International Terrorism 4 Credits
Has global terrorism peaked, or is the worst still to come? This course examines psychological, religious, and political explanations of terrorism; legal and moral statuses of terrorism; explanations for the increasing scale of terrorism and the more frequent targeting of Americans; major terrorist organizations, structures, and means of operation; suicide terrorism; threats and vulnerabilities facing the United States and Western countries today; means of coping with terrorism as an individual and through national policy; possible future developments.
Attribute/Distribution: SS, SW

IR 040 The United Nations 4 Credits
Provides overview of key issues and debates in the United Nations and helps students understand the formal and informal operations of this global organization. We will explore two major questions. First, what are the major obstacles to effective international cooperation in the United Nations? Second, what does globalization mean for UN efforts to promote democracy, development, and human rights? Includes a trip to UN Headquarters in NY and an in-class UN simulation exercise.
Attribute/Distribution: CC, SS, SW

IR 041 U.N. Practicum 1 Credit
Only students participating in the U.N. Youth Representative program are eligible to register for this course. In addition to their regular activities in that program, students are required to maintain a journal of their experiences and write a brief reflective essay on how those experiences have affected their view of international activism, the UN, and the importance on international NGOs. Consent of department required.
Attribute/Distribution: CC, SW

IR 052 Ukraine at the Crossroads: Regime Change and International Politics 4 Credits
This course investigates Ukraine's Orange Revolution, Euromaidan protests, Russia's annexation of Crimea, and the armed conflict in Eastern Ukraine. It will analyze domestic and international causes and consequences of these events through the lenses of news reports, social media, and scholarly publications. The course will introduce students to some basic concepts in the study of domestic and international conflict and facilitate a better understanding of current international events.
Attribute/Distribution: CC, SS, SW, W

IR 056 European International Relations 4 Credits
Examines the evolution of the modern states system in Europe. Conceptual, theoretical and historical topics include the transition from feudalism to the Westphalian system, nationalism, imperialism, the causes of war and attempted peace settlements, the Cold War, the European Union, and the impact of the collapse of the USSR on the political and strategic structure of Europe.
Attribute/Distribution: CC, SS, SW

IR 057 Political Economy of Post-Communist Transitions and European Integration 4 Credits
Central and Eastern Europe, which was once ruled by communist regimes supported by the Soviet Union, underwent radical political and economic transformations in the 1990s. For the first time after decades of communism, East European countries held competitive elections, introduced market principles in their economies, and joined European institutions. This course focuses on the analysis of post-communist economic transitions and the region's economic integration with the European Union.
Attribute/Distribution: SS

IR 061 (ASIA 061) East Asian International Relations 4 Credits
Introduction to East Asian international relations, with emphasis on post-1945 period: historical background of Asian international system; Cold War conflicts; China's rise and regional responses; Japan's changing international role; the two Koreas; ASEAN and Asian regionalism; U.S. and Russian policies; current and future issues.
Attribute/Distribution: CC, SS, SW

IR 063 (ASIA 063) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Attribute/Distribution: CC, SS, SW

IR 066 (ASIA 066) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates.
Attribute/Distribution: SS, SW

IR 074 American Foreign Policy 4 Credits
Addresses major themes and trends in U.S. foreign policy, including its historical evolution. Assesses the interests and values that underlie the goals of policy and the beliefs that shape decisions on how to achieve those goals. Also examines issues such as the constitutional division of authority, bureaucratic politics and processes, civil-military relations, and public opinion.
Attribute/Distribution: CC, SS, SW

IR 082 (JST 082) Middle East in World Affairs Since 1945 4 Credits
Rise of Turkish, Iranian, and Arab nationalism; creation of Israel; decline of British and French power; growth of U.S. and Soviet influence; Middle East as the world's major oil producer.
Attribute/Distribution: CC, SS, SW

IR 086 (JST 086) The Israeli-Palestinian Conflict 4 Credits
Origins of the Zionist movement and of Palestinian national identity. Evolution of the conflict before, during, and after the Israeli War of Independence/Palestinian Nakhba (Catastrophe). 1967 and subsequent occupations. Camp David, Oslo, and subsequent peace negotiations. The 2006 Fatah/Hamas split and state of Palestinian and Israeli politics and policy. Role of the Arab states and of global powers such as the United States.
Attribute/Distribution: CC, SS, SW

IR 100 Methods and Research Design 4 Credits
The course has two principal aims - to introduce students to the logic of social scientific research and to equip them with the basic tools of research design. To that end the course 1) examines controversies surrounding the scientific method; 2) analyzes the logics of experimental, statistical, and case-study methods; 3) explores the most common methodological errors in social scientific research; and 4) gives students a hands-on experience in designing a study.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, SW, W

IR 108 Game Theory and International Politics 4 Credits
The course is designed as a rigorous treatment of the concept of strategic interaction. The focus is on topics like collective action, bargaining under incomplete information, problems of moral hazard and adverse selection, and evolutionary models of interaction. The empirical examples will mostly be drawn from international politics, but anyone curious about the general claim that good outcomes do not necessarily follow from good intentions should find this course interesting.
Attribute/Distribution: MA, Q, SS

IR 119 Issues in International Relations 1-4 Credits
Readings on selected themes in world politics, with theme to change each semester. Offered on an occasional basis only.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

IR 127 Research in International Relations 4 Credits
Research skills in international relations. The role of theory, models and evidence in the explanation of international phenomena. Literature review; problem formulation; theory construction; research design, methods and measures; collection, analysis and interpretation of data; principles of hypothesis testing. Professional writing, either through individual research projects under faculty supervision or an apprenticeship in ongoing faculty research projects. Consent of instructor required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 132 Nationalism and Ethnic Conflict 4 Credits
The ideal of nationalism exerts a powerful pull on almost all people everywhere. This course investigates the sources, spread, and possible future decline of nationalism and national identity, the manipulation of nationalist feelings for political purposes, and the sources of national and ethnic conflict. We will also consider proposals for managing ethnic conflicts and their records of success (or failure). We will study recent and current cases, such as the Israeli-Palestinian conflict, ethnic relations in Iraq and Afghanistan, the Balkans,.
Attribute/Distribution: CC, SS

IR 163 (ASIA 163) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. This is an advanced course on US-China relations. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: CC, SS

IR 164 (ASIA 164) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates. Students may not receive credit for both IR/ASIA 066 and IR/ASIA 164.
Prerequisites: IR 010 or IR 061 or IR 063
Attribute/Distribution: SS

IR 169 Russia and the West 4 Credits
The course is an exploration of the most important issues and debates about the politics of the post-Soviet space. They include the collapse of communism, the collapse of the USSR, the problems of economic and political transition, the conflicts of the post-Soviet space, the problem of selective integration of post-Communist states into the Western integration, and many others.
Attribute/Distribution: CC, SS

IR 177 International Relations of Latin America 4 Credits
Survey of major international and domestic crises facing Central and South America. Examines factors affecting Latin American system of states such as international debt, involvement of foreign powers, and social and political instabilities.
Attribute/Distribution: CC, SS

IR 205 Theories of International Relations 4 Credits
The role of theory in historical explanation, prediction, and policy. Issues of theory design and testing. Important approaches to international relations, including Realism; the Democratic Peace; the domestic politics of foreign policy; history and mythmaking; psychological explanations.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 210 Foreign Policy 4 Credits
This course explores the major international and domestic determinants of foreign policy, as well as contemporary problems associated with the conduct of foreign policy in the 21st century. Principal topics include the influence of the international system, geography, leadership, regime-type, transnationalism, and non-governmental organizations on foreign policy. The course draws upon the experiences of a variety of Western democratic states.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 220 Globalization and World Politics 4 Credits
An exploration of the economic, political, cultural, and military manifestations of globalization and the effects on the internal order of states and the relations among them.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: CC, SS

IR 222 Political Economy of North-South Relations 4 Credits
Political economy of relations between developed and less developed countries. Issues arising from trade, investment, and foreign aid. Consequences of North-South transactions. Controversies over system structure and reform proposals for international institutions (e.g. World Bank, IMF, WTO).
Prerequisites: IR 225 or POLS 225
Attribute/Distribution: CC, SS

IR 223 Work & Labor in a Global Economy 4 Credits
Explores the ways that global economic integration affects workers & the nature of work. Using theoretical frameworks and case studies from around the world investigates issues such as labor standards and labor rights, migration, automation, income inequality both within and across countries, female labor force participation, political power of labor, & transnational labor activism. We will consider the ways that outcomes for workers are different in developed vs. developing economies, democracies vs. non-democracies, according to race, gender, and class status.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: CC, SS

IR 225 (POLS 225) International Political Economy 4 Credits
Principles governing the interaction between the economic and political components of international phenomena. Political aspects of trade, investment, and global economic order. Political underpinnings of international economic relations. Domestic and international political consequences of economic policy and international economic relations.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: CC, SS

IR 226 Political Economy of Corruption II 4 Credits
This course examines causes and consequences of various forms of corruption from the political-economic perspective; helps students better understand various sources, types, patterns, and consequences of corruption; considers corruption that exists in both the public and private sectors; evaluates how corruption affects economic growth and resource allocation; and assesses global and national strategies to reduce corruption. Students may not receive credit for both IR 026 and IR 226.
Prerequisites: ECO 001
Attribute/Distribution: CC, SS, W

IR 229 Issues in International Political Economy 1-4 Credits
Selected issues in international political economy, with theme to change each semester. Offered on an occasional basis only.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

IR 234 Great Power Politics 4 Credits
Overview of the dynamics of strategic interaction between great powers, including the causes of conflict, origins of alliances, logic of coercion, sources of order, and definition of national interests. Focus on the interwar period (multi-polarity), the Cold War (bio-polarity), and the post-Cold War period (uni-polarity).
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 235 International Security 4 Credits
Explanations of international wars, civil wars, genocides, and terrorism. Arms races, escalation, and conflict resolution. The nuclear revolution and ballistic missile defense. Tools of national grand strategy, including alliances, deterrence, coercion, and institutions and norms. Current issues and near future prospects. Case studies.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 236 Causes of War 4 Credits
Systematic examination of major schools of thoughts on the origins and prevention of war, including system-level theories of war and peace, domestic and societal sources of conflict, military policy, and ideational and psychological causes of war. Application and testing of theories to classic cases of war and conflict in history and the contemporary world.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 237 National Security: The Military Instrument of Foreign Policy 4 Credits
This course will begin by exploring the theory, logic and history of US strategy, the elements of ground forces, air power, naval power and nuclear power, and the economics of military strategy. The second half of the course will examine contemporary problems and debates over US security policy.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 242 International Law 4 Credits
This course deals with the nature and sources of international law and the major theoretical and historical developments that have created the legal system of states as it now stands. Topics include: armed conflict, international trade, human rights and international environmental law.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 245 International Organization 4 Credits
Examines how cooperation is achieved and sustained in world politics. Under what circumstances does cooperation take place? What role do formal international organizations play? What is the relative importance of power, ideas, and economic interests? Pursues questions theoretically and in practical terms across topical issues (e.g., humanitarian intervention, environmental protection).
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 257 Political Economy of Post-Communist Transitions and European Integration 4 Credits
Central and Eastern Europe, which was once ruled by communist regimes supported by the Soviet Union, underwent radical political and economic transformations in the 1990s. For the first time after decades of communism, East European countries held competitive elections, introduced market principles in their economies, and joined European institutions. This course focuses on the analysis of post-communist economic transitions and the region's economic integration with the European Union.
Prerequisites: ECO 001
Attribute/Distribution: SS, W

IR 321 Economic Relations of Advanced Industrial Societies 4 Credits
Foreign economic policies of advanced industrial nations. Bilateral and multilateral economic relations; international economic regimes and institutions; interdependence and Cooperation; managing conflict. Consent of department required.
Prerequisites: IR 225
Attribute/Distribution: SS

IR 322 Poverty and Development 4 Credits
Patterns and causes of poverty in poor countries. Diagnosis of development problems and evaluation of development planning. Explanations for choices of development policy, especially issues of trade, foreign aid, and foreign direct investment. Written and oral presentation of individual country research. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, W

IR 323 Political Economy of Industrialization and Development 4 Credits
Political foundation and consequences of economic development and growth. Global inequality in the rates and levels of economic development. Analysis of the differences between the development strategies adopted in different parts of the world. Explanations for patterns of success and failure. Origins of underdevelopment; the politics of failed development strategies; the challenge of the increasingly competitive world economy and relations with the U.S. and other developed nations. Consent of department required.
Prerequisites: IR 225 and IR 010
Attribute/Distribution: CC, SS, W

IR 330 Mass Murder 4 Credits
Is mass murder modern or ancient? Is such violence committed by states or societies? Why do some conflicts degenerate to mass murder and some do not? Are democracies immune to committing this kind of violence? These are just some of the questions that inform the critical examination of the literature on mass murder, which is the principal aim of this course. The prominent cases of mass murder in the 20th century form its main empirical content. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, W

IR 332 The Quest for Peace 4 Credits
The most important focus of the discipline of international relations has been to understand the causes of war and the paths to peace. This course will explore some of the leading contemporary theories of peace and cooperation. It will conclude with a discussion of the prospects for war and peace in the emerging international system.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, W

IR 334 Prospects for Peace in the 21st Century 4 Credits
Will the 21st century be more or less peaceful than the “terrible 20th?” This course examines: globalization as a force both for and against peace, the proliferation of weapons of mass destruction, terrorism, nationalism and communal conflict, humanitarian intervention and peacekeeping, climate change and other issues affecting prospects for peace in the near future. We will also consider the special situation of American as the world's sole superpower, choices in U.S. policy between unilateral and multilateral approaches to preserving global.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 335 Intervention 4 Credits
Strong states frequently intervene in the affairs of weaker societies. Since 1945, the most frequent intervener has been the United States. International norms cut both ways—sovereignty opposes intervention while an emerging “responsibility to protect” sometimes favors it. This course explores why and by what means states and international organizations intervene and what factors influence the success of interventions. We focus mainly on two types – counterinsurgency and humanitarian intervention – that have been and are likely to remain the most.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, W

IR 337 Conflict and Cooperation 4 Credits
The course is designed as an advanced undergraduate seminar to students, who are interested in getting deeper familiarity with the rational choice literature on conflict and cooperation. Its primary focus is on socially suboptimal outcomes in situations that can be modeled as a prisoners’ dilemma, collective action problems, bargaining failures due to incomplete information and commitment problems, etc. The applied material deals with issues like crisis bargaining, alliance politics, revolutions, interventions, trade, democratic transitions, etc. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: CC, SS

IR 344 International Politics of Oil 4 Credits
Historical influence of oil in international politics and the role it plays today. Focus on differing views of producers, such as Middle Eastern and Latin American states, and consuming nations, largely the economically developed Western states. Consent of department required .
Prerequisites: IR 010 or ECO 001
Attribute/Distribution: CC, SS, W

IR 345 Democratization 4 Credits
Interdisciplinary analysis of international and transnational influences on regime transitions. Addresses the role of war, trade, colonial legacies, waves of democratization, socializations, demonstration effects, and international law; the policies of the United States, EU, OAS, UN, World Bank, and NGOs; and the efficacy of different instruments of democracy promotion. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: CC, SS, W

IR 346 Contemporary Ethical Dilemmas in World Politics 4 Credits
This course is designed to explore, challenge, and re-conceptualize the boundaries of moral community and ethical responsibility through such current dilemmas in world politics as famine, terrorism, torture, genocide, weapons of mass destruction, organized crime and more. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 347 Non-State Actors in a Globalized World 4 Credits
Role of non-state political groups (e.g. international advocacy organizations, multinational corporations, news media, terrorists, etc.) in world affairs. Thematic focus on globalization, the relationship between non-state and state actors, and the implications of non-state actors for the future of world order. Themes explored through past and current events (e.g., the WTO demonstrations, 911, the CNN effect, AIDs, anti-sweatshop campaigns.) Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 364 (ASIA 364) Chinese Foreign Policy 4 Credits
Research-oriented seminar focusing on the sources of Chinese foreign policy preferences and goals, foreign policy decision-making processes, international implications of the rise of China, and the pressing regional and global issues that China is facing now and in the future. Students are strongly recommended to take at least one China/East Asia course before, or simultaneously with, IR364. Consent of department required.
Prerequisites: IR 010 or IR 061 or ASIA 061 or IR 062 or ASIA 062 or IR 063 or ASIA 063 or IR 161 or ASIA 161 or IR 163 or ASIA 163
Attribute/Distribution: CC, SS, W

IR 367 International Relations of Russia and other Post-Soviet States 4 Credits
Analysis of foreign relations of Russia and the other fourteen states that emerged after the collapse of the USSR. Consent of department required.
Prerequisites: (IR 010 or IR 169)
Attribute/Distribution: CC, SS, W

IR 388 Honors Thesis in International Relations 4 Credits
International relations majors with senior standing may undertake an intensive, two-semester project under the direct guidance of a faculty member in the student's special area of interest. Students who successfully complete the thesis and whose GPA in the major at the time of graduation is 3.5 or higher receive Departmental Honors. Department permission required. See IR Department website http://cas.lehigh.edu/ir for additional information.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

IR 389 (MLL 389) IR/MLL Capstone Project 4 Credits
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an adviser in IR and one in the relevant language in MLL. Consent of department required.
Attribute/Distribution: CC, SS, W

IR 390 Readings in International Relations 1-4 Credits
Directed course of readings intended for students with special competence or interest in fields of international relations not fully covered by regular course offerings. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS

IR 391 Internship in International Relations 1-4 Credits
Internship in public or private agency. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS

IR 392 Independent Study 1-4 Credits
This course enables students to work with faculty on individual projects and material not covered by the current course offerings. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS

IR 393 Seminar in International Relations 3,4 Credits
Advanced seminar, comparable to other 300level seminars, that focuses on discussion and research on specialized subjects in international relations. Variable subject matter. Junior standing and department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, W

IR 394 Special Topics in International Relations 1-4 Credits
Intensive, research oriented study for students with a special competence or interest in fields of international relations not fully covered by regular course offerings. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, W

IR 493 IR Graduate Seminar 3 Credits
Graduate level research seminar.
Repeat Status: Course may be repeated.

Jewish Studies

Website: http://cjs.cas.lehigh.edu/ **(**http://cjs.cas2.lehigh.edu/**)**

The Jewish studies minor, coordinated by the Philip and Muriel Berman Center for Jewish Studies (http://catalog.lehigh.edu/graduatestudyandresearch/researchcentersandinstitutes/philipandmurielbermancenterforjewishstudies/), provides students with the opportunity to explore the history, literature, religion, and social institutions of the Jewish people from its inception to the present. The diverse selection of courses highlights the interaction of Judaism with other cultures and societies in Europe, the Middle East, and the United States. Students will discover that courses in Jewish studies enhance their understanding of individual and group identity and the dynamics of religious-cultural pluralism. The program is designed to appeal to students with varied interests in any field of concentration. The flexible requirements of the minor in Jewish Studies make it an ideal complement to any major or minor in Arts and Sciences, Business, Engineering, Education, or Health. Students should coordinate their minor program in Jewish studies with the director.

The Berman Center for Jewish Studies supplements formal course offerings through an extensive program of lectures, colloquia, films, field trips, and other cultural events. The Center also provides funding to students to help them pursue study abroad experiences or other enhancements to their academic work in the field of Jewish Studies.

JEWISH STUDIES MINOR

Students pursuing a minor in Jewish studies must fulfill 15 to 16 credit hours.

Four (4) courses from the approved course list or in consultation with the program director. [1]	**15-16**
Total Credits	**15-16**

1

A maximum of eight credit hours of Hebrew may be counted

COURSES

HEBR 001	Elementary Modern Hebrew I	4
HEBR 002	Elementary Modern Hebrew II	4
HEBR 011	Intermediate Modern Hebrew I	4
HEBR 012	Intermediate Modern Hebrew II	4
JST/HIST 031	Empire, War, and Resistance in the Middle East	4
JST/REL 073	The Jewish Tradition	4
JST/REL 081	Jewish Mysticism	4
JST/IR 082	Middle East in World Affairs Since 1945	4
JST/IR 086	The Israeli-Palestinian Conflict	4
JST/REL/ENGL/AAS 102	Promised Lands: Jewish and African American Children's Literature	4
JST/REL 111	Jewish Scriptures/Old Testament	4
JST/REL 112	The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World	4
JST/CLSS/REL 114	Christian Origins: New Testament and the Beginnings of Christianity	4
JST/REL 121	Sources for the Life of Jesus: the Jewish and Christian Context	4
JST/REL 122	Archaeology and the Bible	4
JST/REL 123	Armaggedon: Endtime Thinking in Judaism and Christianity	4
JST/PHIL/REL 129	Jewish Philosophy	4
JST/REL/WGSS 138	Sex, Gender, Jews	4
JST/REL 152	American Judaism	4
JST/REL/HIST 154	The Holocaust: History and Meaning	4
JST/REL 156	Judaism and Comic Books	4
JST/REL/GS 161	Globalization in the Ancient Mediterranean	4
JST/REL 174	Modern Theology	4
JST/REL/THTR 177	Jews and the Broadway Musical	4
JST 180	Independent Study in Jewish Studies	1-4
PHIL 133	Medieval Philosophy	4

Courses

JST 030 (REL 030) Beyond Bagels: Jews and Food 4 Credits
What does Crisco have to do with Jewish history? What is eco-kashrut? And why do so many Jews eat Chinese food on Christmas? This course explores Jewish life through the diverse history of Jewish foods. From New York deli to matzah ball gumbo, we will dig into a rich stew of diverse Jewish practices, regions, genders, ethics, and rituals.
Attribute/Distribution: CC, HE, HU

JST 031 (HIST 031) Empire, War, and Resistance in the Middle East 4 Credits
NEW COURSE PENDING FACULTY APPROVAL -- Over the past 200 years, empires have fought over the control of strategic trade routes and natural resources in the Middle East. Conflicts in Israel-Palestine, Iraq, and Syria emerged with the redrawing of borders. These geo-political changes shed light on how national identities changed but also on how Middle Eastern men and women resisted foreign occupation and domestic dictators alike. Through diverse media such as fiction, photography, and film, this course introduces students to the region’s rich history and legacy.
Attribute/Distribution: CC, HE, SS, W

JST 070 (REL 070) Antisemitism Past and Present 4 Credits
As a ubiquitously present minority in western Christian societies over time, Jews have served as a foil for western identities in ways that continue to resonate in the modern and contemporary contexts. This course will consider the role that anti-Judaism and antisemitism have played in western culture from the ancient period to the present day.
Attribute/Distribution: CC, HE, HU

JST 073 (REL 073) The Jewish Tradition 4 Credits
Judaism is both a textual tradition and a lived religion. Students read basic Jewish texts—Bible, Talmud, Midrash—and study the ways Jews sanctify the life cycle through rites of passage, and the round of the year through the festival cycle.
Attribute/Distribution: HE, HU

JST 081 (REL 081) Jewish Mysticism 4 Credits
This course will examine both the history and the central texts and ideas of the Jewish mystical tradition. We will read a broad range of texts, including the ancient Sefer Yetzirah or Book of Creation, the Zohar, the works of Isaac Luria and his disciples, and the writings of some of the 18th and 19th century Hasidic rabbis. We will also explore the contemporary emergence of Kabbalah and the activities of the Kabbalah Center in contemporary America.
Attribute/Distribution: HE, HU

JST 082 (IR 082) Middle East in World Affairs Since 1945 4 Credits
Rise of Turkish, Iranian, and Arab nationalism; creation of Israel; decline of British and French power; growth of U.S. and Soviet influence; Middle East as the world's major oil producer.
Attribute/Distribution: CC, SS, SW

JST 086 (IR 086) The Israeli-Palestinian Conflict 4 Credits
Origins of the Zionist movement and of Palestinian national identity. Evolution of the conflict before, during, and after the Israeli War of Independence/Palestinian Nakhba (Catastrophe). 1967 and subsequent occupations. Camp David, Oslo, and subsequent peace negotiations. The 2006 Fatah/Hamas split and state of Palestinian and Israeli politics and policy. Role of the Arab states and of global powers such as the United States.
Attribute/Distribution: CC, SS, SW

JST 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

JST 102 (AAS 102, ENGL 102, REL 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: CC, HE, HU, W

JST 111 (REL 111) Jewish Scriptures/Old Testament 4 Credits
The religious expression of the Hebrews, Israelites, and Jews as found in the Jewish Scriptures (TANAK/Christian Old Testament). Near Eastern context of Hebrew religion, the Patriarchs, the Exodus, the monarchy, prophecy, Exile and Return. Emphasis on historical, literary, critical problems, and newer socio-historical methods.
Attribute/Distribution: HE, HU, W

JST 112 (REL 112) The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World 4 Credits
The variety of approaches to Judaism in the period following the Babylonian exile through the second century C.E. The literature studied will include Apocrypha, Pseudepigrapha, and the Dead Sea Scrolls.
Attribute/Distribution: HE, HU, W

JST 114 (CLSS 114, REL 114) Christian Origins: New Testament and the Beginnings of Christianity 4 Credits
Early Christianity from its beginnings until the end of the second century. Coverage includes the Jewish and Hellenistic matrices of Christianity, traditions about the life of Jesus and his significance, and the variety of belief and practice of early Christians. Emphasis on encountering primary texts.
Attribute/Distribution: HE, HU, W

JST 121 (REL 121) Sources for the Life of Jesus: the Jewish and Christian Context 4 Credits
Ancient sources that claim to provide information about Jesus of Nazareth. Approaches taken to Jesus’ life and career; early Christian interpretations of the significance of Jesus; methodology in assessing evidence for the historical Jesus and his message.
Attribute/Distribution: HE, HU, W

JST 122 (REL 122) Archaeology and the Bible 4 Credits
In this course we will examine the way that archaeological work can inform the study of the Bible. One important consideration is how archaeological data have been used either to confirm or falsify the biblical texts. We will look at how archaeologists work and how archaeological data and the Bible intersect. We will examine in detail several archaeological sites in order to understand better the difficulties in interpreting the material remains that archaeologists dig up.
Attribute/Distribution: HE, HU, W

JST 123 (REL 123) Armaggedon: Endtime Thinking in Judaism and Christianity 4 Credits
Thinking about how the world will end was an important feature of certain types of ancient Judaism. Early Christianity took over many of these ideas, and they became fundamental to later Christian theologies, including many that continue to be advocated today. This course will look at ancient Jewish and Christian texts that speak about the end of the world and will trace some of them through more contemporary developments in these two religious traditions.
Attribute/Distribution: HE, HU, W

JST 129 (PHIL 129, REL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HE, HU, W

JST 138 (REL 138, WGSS 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women’s memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children’s literature, among others.
Attribute/Distribution: CC, HE, HU, W

JST 151 (HMS 151, PHIL 151, REL 151) Judaism, Medicine, and Bioethics 4 Credits
This class traces the relationship between Jews and medicine from 1100 to 2020. How does Jewish religion and culture cultivate an affinity for the healing arts? How does Jewish law, ethics, and culture inform contemporary bioethics?
Attribute/Distribution: HE, HU

JST 152 (REL 152) American Judaism 4 Credits
Diverse cultural and social forms through which American Jews express their distinct identity. Is American Jewry an example of assimilation and decline or creative transformation? What, if anything, do American Jews share in common? Compatibility of Judaism with individualism, pluralism, and voluntarism. How have the Holocaust and the State of Israel shaped the self-understanding of American Jewry?
Attribute/Distribution: HE, HU, W

JST 154 (HIST 154, REL 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust.
Attribute/Distribution: CC, HE, HU, W

JST 156 (REL 156) Judaism and Comic Books 4 Credits
Is The Thing Jewish? What does Superman have to do with the bible? Do Orthodox Jewish girls fight trolls? In this course, we will closely examine comic books and graphic novels in order to expand our understanding of what Jewishness might mean. With a POW! and a BAM!, we will consider many topics “from Krakow to Krypton,” including American Jewish history, how representations of Jews are gendered, global Jewish traditions, monsters and mutations, biblical adaptations, and more!
Attribute/Distribution: HE, HU, W

JST 161 (GS 161, REL 161) Globalization in the Ancient Mediterranean 4 Credits
We often think of globalization as a modern phenomenon. Yet as early as the twelfth century BCE, transportation, trade, political and religious networks tied the Mediterranean basin together. This course will examine in three periods-the Late Bronze Age, the Hellenistic period, and the Roman period-how these networks were organized and how they affected a range of Mediterranean and Near Eastern peoples. We will use some modern approaches to globalization as analytical tools for understanding the ancient world.
Attribute/Distribution: HE, HU, W

JST 174 (REL 174) Modern Theology 4 Credits
Major 20th century movements within Christian and Jewish theology understood as responses to the problems of modern times.
Attribute/Distribution: HE, HU, W

JST 175 (GS 175, HIST 175, REL 175) History of Racism, anti-Semitism, and Islamophobia 4 Credits
From the history of slavery in the ancient world to Charlottesville 2017. We will read texts and watch movies that discuss the history of slavery, anti-Semitism, and Islamophobia. The historical meeting of worlds goes from "social slavery" in the ancient world to the "blood laws" in medieval Spain; colonialism in the New World, the rise of biological racism in the nineteenth century, and of cultural racism in the twentieth century.
Attribute/Distribution: CC, HE, SS, W

JST 177 (REL 177, THTR 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels-as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HE, HU, W

JST 180 Independent Study in Jewish Studies 1-4 Credits
Directed readings or research on a Jewish Studies related topic under the direction of a Jewish Studies faculty member. May be repeated for credit up to eight credits. Must have consent of the program director.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

JST 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

JST 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

JST 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

Joint Global Studies and Modern Languages and Literatures

The Joint GS/MLL Major is offered jointly by Global Studies (GS) and the Department of Modern Languages and Literatures (MLL). The mission of the joint major is to provide students with the talent and commitment to develop advanced proficiency in a language other than English within the interdisciplinary Global Studies major.

Global Studies (GS) is an interdisciplinary program in the College of Arts and Sciences that explores the uneven local, regional and global ramifications of the economic, social, political and cultural processes of globalization. The mission of the Global Studies program is to provide students with an interdisciplinary understanding of globalization and contemporary issues, including global inequality.

The Joint GS/MLL Major combines core areas of focus in Global Studies, such as politics, history, and the global economy with rigorous language and culture study. The joint major differs from the regular GS major because of the much higher standard for language study and the greater emphasis on literary and cultural studies offered by the MLL department.

Students in this joint major program are forward thinking scholars. They are able to work with people from diverse backgrounds, capable of thinking critically about topics from multiple perspectives, and possess advanced language and cultural skills.

The Global Studies/MLL joint major program promotes international opportunities for students, specifically requiring an intensive immersion that aligns with the student's language of study. Through an immersive international experience, rigorous classroom collaborations, and engaging faculty and student connections in areas of research and experiential learning, the Joint Global Studies/MLL major program prepares students to be critically engaged citizens of their local, national and global communities.

The BA in Joint Global Studies and Modern Languages and Literatures is outlined below.

The Joint BA in Global Studies/MLL requires a minimum of 46 credits, in addition to the collateral requirements of minoring in a non-English language and Study Abroad in the target language, described as follows:

Collateral Requirements:

Minor in a non-English language: Spanish, French, German, Russian, Chinese or Japanese; and	
Study Abroad: Students must complete a semester-long, 12 credit study abroad program in a country that uses the student's target language of proficiency, with at least half of these (6 credits) earned from courses taught in the target language (including language study). Study abroad may be used to fulfill elective or core course requirements when appropriate, or to complete non-English language study.	

Required Courses (totaling a minimum of 46 credits), as follows:

Language Coursework at the Advanced Level (4 credits)	
French, Spanish, German at 200-level or above	
Japanese, Chinese, Russian at 100-level or above	
Introductory Course (4 credits)	
GS 001	Introduction to Global Studies
Core GS Courses (1 course from each of the areas listed below totaling minimum of 12 credits)	
Culture (choose 1)	
ANTH 011	Cultural Diversity and Human Nature
GS/ANTH 106	Cultural Studies and Globalization
History	
GS/HIST 101	Histories of Globalization
Politics (choose 1)	
IR 010	Introduction to World Politics
GS/POLS 003	Comparative Politics
GS/POLS/PHIL 100	Introduction to Political Thought
Core MLL Course (4 credits)	
GS/MLL 128	World Stories: Fictional Expressions of Globalization
GS Elective Coursework (6-8 credits)	
Select two additional courses from the current Global Studies elective listing. At least one must be 200-level or above.	
MLL Elective Coursework (12 credits)	
Select three additional courses offered in MLL department. At least one must be 100-level or above.	
Senior Seminar, Economy core (4 credits)	
GS/SOC 319	The Political Economy of Globalization

GS/MLL joint majors will enroll in a special section of GS 319 to recognize their unique final research paper requirements. Final research papers will be advised by appropriate MLL faculty and should include at least one primary source in their chosen target language.

Joint International Relations and Economics Major

This major combines international economics, which is the study of markets and economic policy, with international political economy, which studies international institutions and the interactions of states with those institutions and each other, motivated by trade-offs among economic goals and considerations of power, national security, and citizen welfare. Study of economic theory, as well as institutional arrangements, allows students to understand consequences for the world economy, including political and distributional consequences.

Program Advisors:
Professor Dinissa Duvanova, International Relations Department,
Professor Mary Anne Madeira, International Relations Department,
Professor Frank R. Gunter, Economics Department

Collateral course in Mathematics:

Any one of the following courses:		
MATH 021	Calculus I	4
MATH 031	Honors Calculus I	4
MATH 051	Survey of Calculus I	4
MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	4
MATH 081	Calculus with Business Applications I	4

Required Courses (60-61 credits), as follows:

Introductory courses (2 courses/8 credits)		
ECO 001	Principles of Economics	0,4
IR 010	Introduction to World Politics	4
IR Core Courses (4 courses/16 credits)		
IR 100	Methods and Research Design	4
IR 225	International Political Economy	4
Any two of the following courses:		
IR 205	Theories of International Relations	4
IR 210	Foreign Policy	4
IR 220	Globalization and World Politics	4
IR 223	Work & Labor in a Global Economy	4
IR 234	Great Power Politics	4
IR 235	International Security	4
IR 236	Causes of War	4
IR 237	National Security: The Military Instrument of Foreign Policy	4
IR 245	International Organization	4
Economics Core Courses (3 courses/9 credits)		
ECO 045	Statistical Methods	3
ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
Advanced courses in IR (2 courses/8 credits)		
Chosen from any IR courses 300-387 or 393		
Advanced courses in Economics (2 courses/6 credits)		
ECO 234	The Economics of Gender and Race	3
ECO 303	Economic Development	3
ECO 304	Economic Growth	3
ECO 311	Environmental Economics	3
ECO 338	International Economics	3
ECO 339	International Trade	3
ECO 340	International Finance	3
ECO 342	The Chinese Economy - A Comprehensive Study	3
ECO 345	Political Economy of Iraq	3
Electives (4 courses/13-14 credits)		
At least one course chosen from IR 200-387 or 393		
At least two courses chosen from ECO 200+ except ECO 201, 259, 273, 274, 301, 362, 371 and 389		
The fourth may be from either of the two above categories.		

Recommended Economics electives:

ECO 203	Inclusive Finance and Economic Development
ECO 209	Comparative Economic Systems
ECO 303	Economic Development
ECO 339	International Trade
ECO 340	International Finance
ECO 342	The Chinese Economy - A Comprehensive Study
ECO 345	Political Economy of Iraq

Recommended IR electives:

IR 222	Political Economy of North-South Relations
IR 321	Economic Relations of Advanced Industrial Societies
IR 322	Poverty and Development
IR 323	Political Economy of Industrialization and Development
IR 344	International Politics of Oil

Majors in this program may NOT minor or major in either Economics or IR

Joint International Relations/Modern Languages and Literatures Major

Program directors: IR: Yinan He; MLL: Mary A. Nicholas

The multidisciplinary Joint IR/MLL Major is offered jointly by the Department of International Relations (IR) and the Department of Modern Languages and Literatures (MLL). The program, which offers a Bachelor of Arts, incorporates courses from both IR and MLL, as well as electives from a broad cross-section of other departments, for a challenging program that requires overseas study, language facility, and undergraduate research.

The Joint IR/MLL Major recognizes that Lehigh graduates must be adequately prepared to play an active role in the world of the 21st century. For that, they will need an acute understanding of essential issues of global politics, broad linguistic and cultural skills, significant overseas experience, and both intellectual and cultural sophistication. The Joint IR/MLL Major meets those requirements with courses in economics, international relations, language, and culture. Extended study abroad and undergraduate research in more than one language are also required. The program will help students develop a deeper and richer understanding of cultural, linguistic, and political diversity around the world.

The program requires a total of 16 courses for 60-64 credits. At least one semester of study abroad in an approved Lehigh program is required, as is undergraduate research that uses sources in at least one language other than English. Each student will have two major advisors, one each from IR and MLL.

Joint IR/MLL Major

International Relations courses (6 courses/24 credits)		**24**
IR 010	Introduction to World Politics	
Any three of the following courses:		
IR 100	Methods and Research Design	
IR 210	Foreign Policy	
IR 220	Globalization and World Politics	
IR 225	International Political Economy	
IR 234	Great Power Politics	
IR 235	International Security	

IR 236	Causes of War	
IR 237	National Security: The Military Instrument of Foreign Policy	
IR 245	International Organization	
Two IR advanced courses numbered 300-387 (except IR 307) or IR 393		
Modern Languages and Literature courses (6 courses/22-24 credits)		**22-24**
16 credits in one language, either Arabic, Chinese, Hebrew, Japanese, Russian, French (above the level of French 2), German (above the level of German 2), and Spanish (above the level of Spanish 2)		
Two culture courses from an approved list or in consultation with the MLL advisor		
Capstone project: IR 389/MLL 389		**4**
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an advisor in IR and one in the relevant language in MLL.		
Study Abroad		
1 semester or more in an approved Lehigh program		
Electives (3 courses/10-12 credits)		**10-12**
Any IR courses except IR 002, 090, 307, 388, 389, 391, or courses from an approved list.		
Total Credits		**60-64**

Journalism and Communication

Program Chair: Professor Brian Creech

Website: http://journalism.cas.lehigh.edu/

The Department of Journalism and Communication offers two majors: one in Journalism and another in Journalism and Science and Environmental Writing. It also offers a minor in Mass Communication.

Journalism is crucial to the public life of a democracy. At its best, journalism serves as a watchdog to government, offers a voice for the powerless at home and abroad, entertains and instructs the public, represents the views of varied constituencies, monitors and protects the environment and public resources, and provides a common memory for a people.

The purpose of the journalism program is to provide students with the knowledge and skills to fulfill such roles. The program emphasizes research, writing, editing, and critical thinking and analysis. Students integrate online technology with legal and ethical thinking and a global perspective that will prepare them for numerous opportunities in and out of journalism.

In the journalism major, students take courses in writing, editing, visual communication, law and ethics, a professional internship and varied courses in the relationship of the media with society.

A second major available to students is the science and environmental writing program. Students learn to write about pure and applied scientific research, technology, engineering, the environment and medicine and health for a variety of audiences ranging from the general public to scientists and engineers in industry and government. Students can also gain experience in the science and environmental writing field research program. A minor in science and environmental writing is available that may be valuable for students with majors in science or engineering.

An interdisciplinary minor in mass communication is also offered for students to complement their liberal arts education. The minor consists of 15-16 credits of Journalism or Communication classes; the credits can include up to four credits of classes for The Brown and White.

Career opportunities are numerous for graduates of the department. Students find work in traditional journalism organizations, such as newspapers, wire services, magazines, cable, television and radio stations, and other media outlets. Students find work too in new media, such as web sites and other digital production activities.

Students also find work in public relations positions, with responsibilities in government, corporations, hospitals, health care organizations, universities, sports information, nonprofit agencies and other groups.

A background in journalism, with its emphasis on research and writing, also proves to be excellent preparation for many other fields and provides a fine basis for the study and practice of law, graduate study in a variety of disciplines, government service, teaching and business management.

Students in science and environmental writing can expect to pursue careers in science, health and environmental journalism in both the traditional and online media; public relations for scientific societies, environmental organizations, government agencies, universities or hospitals; technical writing for industry and government agencies, and other areas, such as management, administration and teaching. The program also prepares students for graduate study in science or environmental writing, journalism and other disciplines.

The interdisciplinary minor in mass communication will be useful to students interested in organizational and written communication, law, business, philosophy, government, teaching, telecommunication or other careers where understanding of communication is important.

Students are also eligible for scholarships and awards. Incoming high school seniors can apply for the Rodale Scholar award, which provides a scholarship along with opportunities in magazines, books and multimedia. Lehigh Journalism students compete for an array of prestigious writing prizes that include the William Prizes in Journalism, the Kachel Awards in Writing, the Cagan Award for reporting, the Strassberg Award for research, and the Jesse Siegel Writing Award. Recent donations allow students to travel to professional workshops and conferences.

REQUIRED MATH COURSE

Understanding statistical information has become extremely important in modern society. MATH 012, Basic Statistics, is required for students taking a journalism or science and environmental writing major. Students should take MATH 012 to fulfill the college's distribution requirement. ECO 045, Statistical Methods, is an acceptable alternative for the statistics requirement for students taking the journalism or science and environmental writing major, but it does not satisfy the college's distribution requirement.

JOURNALISM MAJOR

Core Courses		
JOUR 001	Brown and White	1
JOUR 002	Brown and White	1
JOUR 003	Brown and White	1
JOUR 004	Brown and White	1
COMM 001	Media and Society	4
JOUR 021	Writing for the Media	4
JOUR 023	Editing	4
JOUR 024	Visual Communication	4
JOUR 025	Data Journalism	4
JOUR 122	Media Ethics and Law	4
JOUR 275	Writing for Media II (Course fulfills university junior writing intensive requirement)	4
Senior Seminar: Journalism or Communication course at 300 level		4
Capstone (Choose one among three in consultation with adviser)		
JOUR 361	Internship	4
JOUR 375	Writing for Media III	4
JOUR 390	Honors Thesis	1-4
Required Elective		
Select one additional Journalism or Communication course.		
Collateral Requirements		
Students must also complete a second major, OR a minor outside of the Department of Journalism and Communication.		

[1]

NOTE: Students must consult an adviser in choosing the elective course as not all courses with JOUR or COMM designations can be used.

JOURNALISM/SCIENCE AND ENVIRONMENTAL WRITING MAJOR

Core Courses		
JOUR 001	Brown and White	1
JOUR 002	Brown and White	1
or JOUR 231	Science Writing Practicum	
Select one of the following:		4
JOUR 123	Course JOUR 123 Not Found	
JOUR 311	Course JOUR 311 Not Found	
JOUR 021	Writing for the Media	
JOUR 023	Editing	4
JOUR 024	Visual Communication	4
JOUR 230	Multimedia Storytelling	4
JOUR 275	Writing for Media II (Choose between Jour 230 or Jour 275)	4
Advanced Courses		
JOUR/STS 124	Course JOUR 124 Not Found	4
JOUR 125	Environment, the Public and the Mass Media	4
JOUR/STS/HMS 323	Health and Environmental Controversies	4
JOUR 361	Internship	4
Required Electives		
Select one additional 4-credit Journalism or Communication course. [1]		4
Total Credits		**42**

[1]

NOTE: Students must consult an adviser in choosing the elective course as not all courses with JOUR or COMM designations can be used.

Collateral Requirements

Students must also complete 15-16 credits in science for the journalism/science and environmental writing major.

Required science courses

A minimum of 15-16 credits in the physical, biological, environmental or social sciences or engineering is required. These hours can be concentrated in any one area or distributed among all five areas, although an area concentration is recommended. Dual majors in journalism/science and environmental writing and a science are encouraged. Science courses should be chosen in consultation with the major adviser.

Science and environmental writing field research program

Available to science, environmental and technical writing students at the junior or senior level, this program provides practical experience in scientific research and science writing for students who work on and write about research projects directed by university scientists and engineers. Another segment of the program allows students to attend major scientific meetings as fully accredited science reporters. Students observe professional science writers in action and write their own stories about the scientific sessions and press conferences held at the meetings.

SCIENCE AND ENVIRONMENTAL WRITING MINOR

JOUR 001	Brown and White	1
or JOUR 231	Science Writing Practicum	
JOUR 021	Writing for the Media	4
or JOUR 123	Course JOUR 123 Not Found	
JOUR 124	Course JOUR 124 Not Found	4
JOUR 125	Environment, the Public and the Mass Media	4
JOUR 323	Health and Environmental Controversies	4
Total Credits		**17**

MASS COMMUNICATION MINOR

Purpose

The Mass Communication Minor focuses on how information is disseminated and the effect on the shaping of societies. As traditional forms of mass communication change and new forms arise, it is more important than ever to understand the interplay of the media and society. In this minor, students will learn to evaluate and interpret media messages so that they can understand and participate in this increasingly complicated world. They can also choose to combine theory with practice in research, interviewing, writing, visual communication and editing to enhance their skills in those areas. Because the minor draws on the same courses, it is not open to majors in Journalism or Journalism/Science and Environmental Writing.

Requirements

The minor requires 15 credits of classes in JOUR and/or COMM. Students can count up to 4 credits of The Brown and White toward the minor.

PREREQUISITES FOR JOURNALISM COURSES

NOTE: Journalism and Communication courses build on one another. Some courses thus require prerequisites before students can register for the class. Check the course schedule each semester.

MEDIA INTERNSHIPS

All majors in journalism and journalism/science and environmental writing are provided with professional internships during their senior year or the preceding summer. The internships provide real-world experience with newspapers, magazines, cable, television or radio stations, web sites or in public relations settings. Science writing minors may take an internship instead of working on The Brown and White.

Communication Courses

COMM 001 Media and Society 4 Credits

This introduction to the roles of mass media in U.S. and global society explores a media-saturated society. Students learn how mass media operate in relationship to society, controversies surrounding their activities, social consequences of media behavior, and theories for examining mass media. Restricted to CAS students but other colleges and upperclassmen allowed by instructor's permission.
Attribute/Distribution: CC, SS, SW

COMM 091 Special Topics 1-4 Credits

Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

COMM 102 (DOC 102, FILM 102, GS 102, JOUR 102) The Sports Documentary 4 Credits

The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society's most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN's "30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.
Attribute/Distribution: HE, HU

COMM 104 (DOC 104, FILM 104) The Last Dance: Documentary Storymaking 4 Credits
This class explores documentary storytelling through an in-depth case study of the sports documentary "The Last Dance," the 10-part award-winning film series on basketball's Michael Jordan and the Chicago Bulls. Critical study of the making of "The Last Dance" reveals the numerous legal, ethical, creative, economic, technical, aesthetic and other considerations that go into the practice of documentary story making.
Attribute/Distribution: HE, HU

COMM 119 (JOUR 119) Mobile and Social Media Storytelling 4 Credits
Learn how to take a better photo, record a better video or podcast, and produce better social media content for your newsroom, company, or brand — all with your smartphone. This is a hands-on, highly practical online course that will have you learning tools and principles for visual and audio storytelling. You'll be producing content in the community that surrounds you and publishing exclusively to social media platforms. (Access to a smartphone is required).
Attribute/Distribution: AL, SS

COMM 130 Public Speaking 4 Credits
Applying the principles of public speaking to making informative and persuasive presentations effectively. Emphasis on speech composition and effective oral communication skills.
Attribute/Distribution: AL, HU

COMM 135 (JOUR 135) Human Communication 4 Credits
Processes and functions of human communication in relationships and groups.
Attribute/Distribution: SS, SW

COMM 143 Persuasion and Influence 4 Credits
The social, symbolic, and rhetorical means of persuasion and how this persuasive influence is expressed in politics, advertising, and the mass media. Students will gain experience in evaluating and creating persuasive communication messages and campaigns.
Attribute/Distribution: SS, SW

COMM 147 (AAS 147) Dreams and Nightmares: The Music Industry, Media and Inequality 4 Credits
What were the racial and gendered stakes when Kanye West interrupted Taylor Swift at the MTV Video Music Awards? How do sexual assaults by famous musicians go under-investigated and under-covered? What are the structures of the music industry that enable inequity? This course addresses these questions and problematic hierarchies within the global popular music industry, situates musical case studies in social, news and entertainment media environments, and highlights the role of music journalism in setting the terms of key debates.
Attribute/Distribution: SS, SW

COMM 150 (HMS 150) Health Communication 4 Credits
Knowledge of health communication is an essential foundation for anyone working in the field. Yet communicating about health is often complex and multi-faceted. To better understand health communication, we will explore the role of media and persuasion. We'll examine media coverage of health information; communications on risks and epidemics; theories and research of health behavior; effects of communication technologies on health communication; communicating about health data and information; health campaigns; engaging with individuals and communities with health messages and more.
Attribute/Distribution: SS, SW

COMM 165 Data Storytelling 4 Credits
The availability of large amounts of data offers new insights for many fields, such as computer science, marketing, health and journalism. Data storytelling -- the ability to gather, analyze, visualize and tell stories with data -- has become a sought-after skill. This course, designed for students with skills or prior experience in data analytics, statistics, math or programming, demonstrates the value of data storytelling for all fields and provides students with advanced tools to create meaningful, compelling data stories.
Attribute/Distribution: Q, SS, SW

COMM 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

COMM 252 Social and Psychological Effects of Communication Technology 4 Credits
Communication technology, ranging from the Internet and social media to robots and the Internet of Things, has changed the ways that we communicate, think and behave, and reshaped our society as a result. In this class, we discuss the impact of communication technology and the social and psychological mechanisms through which such impact is made possible. Specifically, we will look at how technology affects cognition, attitude and action of individuals and among groups. Open to all students.
Attribute/Distribution: SS, SW

COMM 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

COMM 300 Apprentice Teaching 1-4 Credits

COMM 352 Social and Psychological Effects of Communication Technology 4 Credits
Communication technology, ranging from the Internet and social media to robots and the Internet of Things, has changed the ways that we communicate, think and behave, and reshaped our society as a result. In this class, we discuss the impact of communication technology and the social and psychological mechanisms through which such impact is made possible. Specifically, we will look at how technology affects cognition, attitude and action of individuals and among groups. Senior seminar open to majors only.
Attribute/Distribution: SS, SW

COMM 375 (AAS 375) Global Media and Culture 4 Credits
Cultural Studies investigates dominant understandings; issues of identity and experience; and society. A Cultural Studies approach to understanding representations of difference in global media. Focus will center upon the role of media in shaping the contemporary dominant understandings of various groups in a globalized world; introductions to philosophies and theories that function as fundamental texts on the relationship between media, social life and human behavior; and the ways in which media socially construct a new, globalized reality.
Attribute/Distribution: CC, SS

COMM 385 Seminar in Communication Issues 3-4 Credits
A seminar focusing on contemporary issues and problems facing the mass media and communication. Topics vary. Taken by seniors for 4 credits and graduate students for 3 credits. Open to senior journalism or senior journalism/science writing majors or have consent of the instructor.
Attribute/Distribution: SS

COMM 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

Journalism Courses

JOUR 001 Brown and White 1 Credit
This course is a student's first semester on the staff of the semiweekly undergraduate newspaper. Students register for this course, attend a meeting on the first Wednesday of the semester, and are placed on the staff. Because this is an introductory training class, JOUR 001 is for students with freshman or sophomore standing; juniors only with consent of department chair.
Attribute/Distribution: ND

JOUR 002 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 001
Attribute/Distribution: ND

JOUR 003 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 002
Attribute/Distribution: ND

JOUR 004 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 003
Attribute/Distribution: ND

JOUR 005 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 004
Attribute/Distribution: ND

JOUR 006 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 005
Attribute/Distribution: ND

JOUR 007 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 006
Attribute/Distribution: ND

JOUR 008 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 007
Attribute/Distribution: ND

JOUR 009 Brown and White Photography 1 Credit
Enrollment constitutes membership on the photography staff of the semiweekly undergraduate newspaper. Students should have basic camera skills and knowledge of digital photography. Classes will include review of these subjects and more advanced techniques in digital darkroom techniques. Members of the class work on a series of assignments for the newspaper. Students should have their own digital SLR camera equipment and will be expected to provide examples of their work for admission to the class.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 010 Brown and White 1-2 Credits
Enrollment constitutes an editorial position on the staff of the semiweekly undergraduate newspaper. Editors are chosen by the instructors and the newspaper's editorial board. Consent of department required.
Repeat Status: Course may be repeated.
Prerequisites: JOUR 001
Attribute/Distribution: ND

JOUR 011 Brown and White Projects 1-4 Credits
This section of The Brown and White is devoted to special projects that fall outside or complement traditional sections and can include investigative reporting, podcasts, partnerships with other media organizations, such as WLVR and PBS, data stories, experiments in new forms of storytelling and other efforts. Instructor Permission.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 012 Brown and White Videography 1 Credit
Enrollment constitutes membership on the videography staff of the student newspaper. Students should have basic camcorder skills and knowledge of editing video. Members of the class use the newspaper’s video equipment and work on assignments for the newspaper’s Web site. First-time students should provide examples of their work for admission to the class. Does not count in department‘s majors or minors.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 021 Writing for the Media 4 Credits
Practice gathering, writing and editing news; definition and components of news; structure and style; interviewing. Study and practice in use of social media and blogs by journalists as a way to gather and publish information. Requires freshman or sophomore standing.
Attribute/Distribution: AL, W

JOUR 023 Editing 4 Credits
Students will strengthen news judgment, critical thinking and writing through careful editing of articles for accuracy, fairness and clarity, including use of proper spelling, grammar, usage and style. Practice in writing headlines for print and the Web, including search engine optimization and multimedia presentation of content.
Prerequisites: JOUR 021 or JOUR 123
Attribute/Distribution: AL, SS

JOUR 024 Visual Communication 4 Credits
Study of and practice in techniques of multimedia storytelling including photography, data visualization, print layout, and video-shooting and editing skills. This course combines principles of visual communication with hands-on work to help improve your visual literacy and multimedia skills and develop a professional digital portfolio. Prerequisite: Jour 21 or Jour 123.
Prerequisites: JOUR 021 or JOUR 123
Attribute/Distribution: AL, SS

JOUR 025 Data Journalism 4 Credits
Journalists, now more than ever, need to be able to use data as any other type of information for news reporting and storytelling. This introductory course, designed for journalism majors, encourages students to understand data as a natural source of journalism, understand the core concepts of data journalism, gain capacity and literacy to assess data for news reporting, and learn skills and tools for searching and using datasets as a part of journalistic practices.
Prerequisites: JOUR 021
Attribute/Distribution: Q, SS, SW

JOUR 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

JOUR 102 (COMM 102, DOC 102, FILM 102, GS 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society's most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN's "30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.
Attribute/Distribution: HU

JOUR 110 (LAS 110) Latinx & Latin American Media 4 Credits
The cultures, languages, and traditions of Spanish-language and Latinx media in the U.S. and globally will be examined. The course presents frameworks for understanding media development and performance, discusses the role of media in democratic societies, and identifies common patterns in Latin American media development, media ownership, media-state relationships, relations with societal groups and citizens, and media content. Students identify and analyze societal and international forces that explain why these patterns appear, persevere and, sometimes, change.
Attribute/Distribution: HE, SS

JOUR 118 Sports Journalism 4 Credits
Fundamentals and practice of sports coverage through hands-on multimedia news gathering techniques in the field. Practice sports writing, photography, and video shooting and editing targeted for publications in both traditional and digital platforms.
Attribute/Distribution: AL

JOUR 119 (COMM 119) Mobile and Social Media Storytelling 4 Credits
Learn how to take a better photo, record a better video or podcast, and produce better social media content for your newsroom, company, or brand — all with your smartphone. This is a hands-on, highly practical online course that will have you learning tools and principles for visual and audio storytelling. You'll be producing content in the community that surrounds you and publishing exclusively to social media platforms. (Access to a smartphone is required).
Attribute/Distribution: AL, SS

JOUR 122 Media Ethics and Law 4 Credits
First Amendment theory and history; ethical and legal issues involving libel, privacy, obscenity, newsgathering, access, and fair trials; national and international concerns over censorship, prior restraint and manipulation and control of information.
Attribute/Distribution: SS, SW

JOUR 125 (EVST 125) Environment, the Public and the Mass Media 4 Credits
Extensive exploration of local, national and international environmental problems and their social, political and economic impacts. Analysis of mass media coverage of complex environmental issues and the media's effects on public opinion and government environmental policies. Examination of environmental journalism principles and practices in the United States and around the world.
Attribute/Distribution: CC, SS, SW

JOUR 135 (COMM 135) Human Communication 4 Credits
Processes and functions of human communication in relationships and groups.
Attribute/Distribution: SS, SW

JOUR 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

JOUR 225 PBS-NPR Partnership 4 Credits
For decades, the Public Broadcasting Service and National Public Radio – PBS and NPR – have offered high-quality television, radio and digital journalism to American audiences. Lehigh University is fortunate to have PBS and NPR stations right on the edge of our campus. This class takes advantage of that fortune and offers Lehigh journalism students the opportunity to partner with PBS and NPR journalists to produce in-depth stories for television and radio as well as digital outlets.
Repeat Status: Course may be repeated.
Prerequisites: JOUR 023 or JOUR 024
Attribute/Distribution: HU

JOUR 230 Multimedia Storytelling 4 Credits
An introduction to storytelling across multimedia styles such as video, audio, photography, social media, and written word. stresses experiential learning with emphasis on complementary story packaging and publishing. Students do in-class assignments and team reporting on issues of concern to local residents.
Prerequisites: JOUR 024
Attribute/Distribution: SS

JOUR 231 Science Writing Practicum 1-4 Credits
Onsite experience as accredited science reporter at major scientific meetings, or writing and research in university laboratories as part of science writing field research program. Must have junior standing. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: JOUR 021 or JOUR 123 or JOUR 311
Attribute/Distribution: ND

JOUR 232 Journalism Practicum 1-4 Credits
Credit for supervised on- and off-campus work in journalism and communication. Allows credit for internships attained by students who do not qualify for the senior-level journalism internship class. Must have completed eight hours of journalism credits or consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 245 Media Entrepreneurship 4 Credits
This class is designed to provide students with the journalistic, technological, business and entrepreneurial tools they need to consider working on their own. Students will examine traditional and emerging business models and understand the opportunities and challenges presented by the start-up economy. Ultimately, students will attempt to convert their intellectual, political, cultural or artistic passions into a viable media business.
Attribute/Distribution: SS

JOUR 246 (GS 246) International Communication 4 Credits
The subject matter is crucial to understanding modern life: the role of international news media in world affairs. The class studies the social, political and economic contexts that frame the reporting of international events by U.S. news media, such as politics, war, disasters, and other crises, as well as U.S. reporting on international issues, such as poverty, disease, and environmental change. The course also surveys reporting practices in nations around the world, including the varying systems of journalism and mass media and the brutal censorship and repression facing many foreign journalists.
Attribute/Distribution: SS

JOUR 275 Writing for Media II 4 Credits
This course fulfills the college junior-level writing intensive requirement and is required by the majors of Journalism and Journalism/Science Writing. Building on Writing for the Media I, the class combines essential aspects of Jour 211 Reporting, Jour 212 Feature Writing and Jour 218 Freelance Writing. Students will report and produce in-depth stories, to be published in The Brown and White, in paper and online, which will add substantially to their portfolios.
Prerequisites: JOUR 021 and JOUR 023
Attribute/Distribution: SS, W, WRIT

JOUR 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

JOUR 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

JOUR 312 Advanced Science Writing 3 Credits
Further practice, on individual basis, in science writing techniques.
Prerequisites: JOUR 123 or JOUR 311
Attribute/Distribution: SS

JOUR 313 Special Topics in Science Communication 1-4 Credits
Research or writing involving a topic, medium or issue in science, environmental or technical communication not covered in other courses. Must have completed eight hours in science or environmental writing or have consent of the instructor.
Attribute/Distribution: SS

JOUR 323 (EVST 323, HMS 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.
Attribute/Distribution: SS, SW

JOUR 333 (AAS 333) Reporting the Crises: Identity, Journalism and Power 4 Credits
This seminar helps students understand the role of journalists, media-makers and citizens at the intersection of identity and inequality in times of crisis. It covers issues of race, class and gender with a specific emphasis on anti-Black racism, showing how media can be consciously or unwittingly used to further discrimination and support ongoing structures and patterns of harm. Ultimately students will explore how new media platforms, organizations and workers might undertake more equitable practices for a more equal media future.
Attribute/Distribution: CC, SS

JOUR 361 Internship 4 Credits
Professionally supervised work on newspapers, magazines, Web sites radio and television stations, or with public relations organizations. Some internships involve science writing. Must have senior standing and declared major in journalism or science writing.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 375 Writing for Media III 4 Credits
Building on Writing for the Media I and II, the class will offer different approaches and different platforms to advanced writing for media, from long-form journalism to multimedia storytelling to telling stories with data and visuals to experiments with new forms of storytelling. Prerequisite: JOUR 275 (SS).
Prerequisites: JOUR 275
Attribute/Distribution: SS, W

JOUR 385 Seminar in Journalism Issues 3-4 Credits
A seminar focusing on contemporary issues and problems facing the mass media and journalism. Topics vary. Taken by seniors for 4 credits and graduate students for 3 credits. Open to senior journalism or senior journalism/science writing majors or have consent of the instructor. Attribute/Distribution: SS.
Attribute/Distribution: SS

JOUR 389 College Scholar Project 1-8 Credits
Opportunity for college scholars to pursue an extended project. College wide course designation. Transcript will identify department in which project was completed. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 390 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of students who apply for and qualify for graduation with departmental honors. Qualifications are 3.75 GPA in the major and 3.5 overall GPA.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 391 Special Topics in Journalism and Communication 1-4 Credits
Directed research or writing involving a subject or issue in journalism not covered in other courses. Must have completed twelve hours in journalism or have consent of the instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

Latin American and Latino Studies

Website:http://las.cas.lehigh.edu/ **(**http://las.cas2.lehigh.edu/**)**

The Latin American and Latino Studies program is designed for students who wish to develop an understanding of a neighboring region that is of vital importance to the United States, and also of those Latino communities within the United States itself. Courses in anthropology; archeology; foreign policy; history; language and literature; politics; sociology; and art, architecture and design allow students to explore various aspects of Latin American and Latino cultures and societies from an interdisciplinary perspective. The program contributes to a liberal arts education by offering students an international vantage point from which they can examine the cultural complexity of their own society, preparing them to meet the challenges of an increasingly interdependent world. Additionally, the unprecedented movement of peoples and ideas between the American continents in recent decades makes the study of Latin America and its connections to the U.S. Latino population an essential component for understanding the history and culture of globalization in the Americas. The major and minor in Latin American and Latino Studies thus complement the study of other disciplines with either an international or a domestic focus, and enhance the relevance of a Lehigh education by preparing students to be citizens of a culturally diverse society and, more generally, of the Americas.

THE MAJOR

The major in Latin American and Latino Studies requires a minimum of 10 courses with four courses at the 200/300 level. Students are required to possess intermediate language proficiency in Spanish. Courses taken as study abroad may fulfill program requirements with approval of the program director.

Required Core Course [1]		**4**
LAS/GS/HIST 049	The True Road to El Dorado: Colonial Latin America	
LAS/GS/HIST 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence	
LAS/ENGL 105	Intro to Latino/a Literature and Culture	
LAS/SPAN 152	Cultural Evolution of Latin America	
Language Requirement		**4**
SPAN 012	Intermediate Spanish II	
Humanities Requirement [2,3]		**7-8**
Two classes from the list of electives that carry a HU distribution.		
Social Sciences Requirement [2,3]		**7-8**
Two classes from the list of electives that carry a SS distribution.		
Additional Electives [2, 3]		**14-16**

Four courses chosen from the list of approved electives. Additional electives may be chosen in consultation with the Program Director.	
Total Credits	**36-40**

[1]

Courses taken and not used to fulfill core requirement may fulfill elective requirement.

[2]

No less than three courses in Latino Studies.

[3]

No more than two courses in Spanish at the 200/300 level may count toward the major.

LATIN AMERICAN STUDIES ELECTIVES

Each semester, a complete list of Latin American Studies course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

ANTH 178	Mesoamerican Archaeology	4
HIST 368	Seminar in Latin American History	4
IR 177	International Relations of Latin America	4
IR 222	Political Economy of North-South Relations	4
IR 323	Political Economy of Industrialization and Development	4
LAS/GS/HIST 049	The True Road to El Dorado: Colonial Latin America	4
LAS/GS/HIST 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence	4
LAS/ANTH/GS 117	Archaeology of Latin America	4
LAS/HIST 149	Narcos: The Global Drug Wars	4
LAS/SPAN 152	Cultural Evolution of Latin America	4
LAS/AAS/SOC 155	Afro-Latino Social Movements in Latin America & the Caribbean	4
LAS/ANTH 184	Indigenous Cultures of Latin America	4
LAS/GS/MLL/ENGL 202	Latin America In Fact, In Fiction	4
LAS/SPAN 211	Business Spanish	4
LAS/SPAN/FILM 213	Introduction to Hispanic Literature and Film	4
LAS/SPAN 243	Indigenous Cultures in Spanish America	4
LAS/SPAN 263	The Spanish American Short Story	4
LAS/SPAN/FILM 265	Spanish and Latin American Cinema	4
LAS/GS/ENGL/MLL 302	Travel and Adventure in Latin American Fiction	4
LAS/SPAN 320	Literature of the Spanish Caribbean	4
LAS/HIST 369	Columbus on Trial: A Critical Reading of the Spanish Conquest	4
LAS/SPAN 391	Melodrama in Contemporary Spanish American Narrative	4
LAS/SPAN 392	The City and the Country in Spanish American Narrative	4
LAS/SPAN 393	The Boom and Beyond	4
LAS 394	Special Topics	1-4
POLS 335	Latin American Political Systems	4
POLS 336	U.S. Foreign Policy and Latin America	4
POLS 337	Religion and Politics in Latin America	4
POLS/WGSS/GS 342	Gender and Third World Development	4

LATINO STUDIES ELECTIVES

Each semester, a complete list of Latino Studies course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

LAS/ENGL 105	Intro to Latino/a Literature and Culture	4
LAS/AAS/SOC 106	Race and Ethnicity in the Americas	4
LAS/ART 227	Latin American Art	4
LAS/SPAN 325	Hispanic Literature of The United States	4
POLS 336	U.S. Foreign Policy and Latin America	4
SOC 115	A Nation of Immigrants: The American Experience	4

THE MINOR

The Latin American and Latino Studies minor program requires 15 to 16 credit hours of coursework. In addition to regular Lehigh offerings, students may receive minor credit for appropriate courses at other LVAIC institutions, study abroad programs in Latin America, and various Lehigh faculty-led programs, such as “Lehigh in Martinique” and “Lehigh in Costa Rica” (both offered during the winter term). Students are encouraged to take advantage of extracurricular activities sponsored by the Latin American and Latino Studies Program, which include guest speakers, exhibits, films, etc.

Required core course (choose one)		**4**
LAS/GS/HIST 049	The True Road to El Dorado: Colonial Latin America	
LAS/GS/HIST 050	Heroes, Dictators, and Revolutionaries: Latin America since Independence	
LAS/ENGL 105	Intro to Latino/a Literature and Culture	
LAS/SPAN 152	Cultural Evolution of Latin America	
Language Requirement		**4**
SPAN 011	Intermediate Spanish I	
Electives [1,2]		**7-8**
Total Credits		**15-16**

[1]

Elective courses (7-8 credits) chosen from LAS cross-listed courses or collateral courses. Credit may be received for other courses including study abroad, in consultation with the Program Director.

[2]

Special topics courses in Art and History may be applicable electives to the Latin American Studies minor. Refer to course listings for ART 269 Special Topics in Art History, ART 273 Special Topics in Studio Practice, ART 370 Special Topics in Museum Studies, ART 375 Museum Internship, HIST 104 Course HIST 104 Not Found, and HIST 303 Course HIST 303 Not Found. SPAN 290 Course SPAN 290 Not Found may also be applied as a LAS elective. Students should consult with the Program Director for approval of any of the previous listed courses.

Courses

LAS 049 (GS 049, HIST 049) The True Road to El Dorado: Colonial Latin America 4 Credits

Examines the initial encounters of peoples of Iberian and African origins with the indigenous civilizations of the Western Hemisphere. Explores the development of a colonial economy and its global reach. Focuses on the birth of a distinctive Latin American society and culture, with attention to the Latin American patriots who fought for their freedom. No prior knowledge of Latin American history required. **Attribute/Distribution:** CC, SS, SW, W

LAS 050 (GS 050, HIST 050) Heroes, Dictators, and Revolutionaries: Latin America since Independence 4 Credits
Examines the 200-year-long struggle of Latin American peoples to gain political representation, economic equality, and social justice. Explores key historical events in Latin America from the movement for independence in the early nineteenth century to today's modern societies. Topics include the wars of independence, the rule of caudillos, foreign military interventions, export economies, populism, social revolutions, the Cold War era, state terror and military dictatorships, and the war on drugs.
Attribute/Distribution: CC, SS, SW, W

LAS 091 Special Topics 1-4 Credits
A topic, genre, or approach in literature, history, or social sciences not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

LAS 105 (ENGL 105) Intro to Latino/a Literature and Culture 4 Credits
This course provides an overview of the literary history and criticism of Latino/a literature and media. Through a combination of critical and literary theory, we will focus on works Latino/a-centered texts including poetry, prose, film, and television which portray issues of migration/immigration, colonialism, history, race, and gender. We will also examine the role of literature in the development of Latino/a Studies. Authors and scholars featured in the course include José Martí, Pura Belpré, Pedro Pietri, the Young Lords Party,.
Attribute/Distribution: HU

LAS 106 (AAS 106, SOC 106) Race and Ethnicity in the Americas 4 Credits
How is it possible that someone who is officially considered black in the United States can embody different racial identities throughout current Latin America? Even more, how is it possible that people considered white nowadays were not officially so in early twentieth-century US (although they were viewed as white in the Latin American context at the same time period)? This course offers a historical comparative analysis of the nature and dynamics of race between the United States and Latin America.
Attribute/Distribution: CC, SS, SW, W

LAS 110 (JOUR 110) Latinx & Latin American Media 4 Credits
The cultures, languages, and traditions of Spanish-language and Latinx media in the U.S. and globally will be examined. The course presents frameworks for understanding media development and performance, discusses the role of media in democratic societies, and identifies common patterns in Latin American media development, media ownership, media-state relationships, relations with societal groups and citizens, and media content. Students identify and analyze societal and international forces that explain why these patterns appear, persevere and, sometimes, change.
Attribute/Distribution: HE, SS

LAS 117 (ANTH 117, GS 117) Archaeology of Latin America 4 Credits
Explores the past of Latin America and the major civilizations that existed prior to European arrival and colonization. Extending from Mesoamerica through the Southern Andes, topics covered include the monumental structures, belief systems, and trade networks that made sure an entire continent was interconnected for millennia. This course also looks at the ways in which European colonialism has shaped the perception of these civilizations and how modern pseudoarchaeology continues to deny the accomplishments of indigenous cultures.
Attribute/Distribution: CC, SS, SW, W

LAS 149 (HIST 149) Narcos: The Global Drug Wars 4 Credits
Tobacco, sugar, coffee, opium, marijuana, cocaine. From Columbus's encounter with the New World to the rise and demise of Pablo Escobar and "El Chapo" Guzmán, drugs have been coveted global commodities. Through readings, discussions, and films, this course examines the history of drug production, drug trafficking, and the so-called "war on drugs" in Latin America.
Attribute/Distribution: CC, SS, SW, W

LAS 152 (SPAN 152) Cultural Evolution of Latin America 4 Credits
The historical and cultural evolution of Latin America. Discussion of representative literary works in their cultural and historical contexts. Prerequisite as listed below or consent of instructor.
Attribute/Distribution: CC, HE, HU, W

LAS 155 (AAS 155, SOC 155) Afro-Latino Social Movements in Latin America & the Caribbean 4 Credits
This course focuses on Afro-Latinos who make up nearly 70% of the population of the Americas. Despite the large amount of people of African descent living in the Americas, Afro-Latinos are an understudied population who face significant amounts of racial discrimination in their countries. Who are Afro-Latinos? Where do they live? How are they challenging the racism that they face? These are questions we will tackle in this course.
Attribute/Distribution: CC, SS, SW

LAS 184 (ANTH 184) Indigenous Cultures of Latin America 4 Credits
This examines social change in Latin America from the perspective of indigenous peoples. Main goals are to develop an appreciation for the diversity of cultures found in Latin America, explore anthropological concepts like cultural ecology, ethnicity, acculturation, and religious syncretism, and to apply these concepts to contemporary issues, including cultural survival, human rights, and environmental sustainability.
Attribute/Distribution: CC, SS, SW, W

LAS 191 Special Topics 1-4 Credits
A topic, genre, or approach in literature, history, or social sciences not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

LAS 202 (ENGL 202, GS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HE, HU

LAS 211 (SPAN 211) Business Spanish 4 Credits
An introduction to business concepts and vocabulary in Spanish. Specialized professional vocabulary and business culture in Spanish-speaking countries.
Prerequisites: SPAN 141
Attribute/Distribution: HU

LAS 213 (FILM 213, SPAN 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

LAS 227 (ART 227) Latin American Art 4 Credits
Presents an overview of the origins and development of Latin American art since the independence period in the 19th century through the present. Understanding "Latin" American as a cultural construct that extends from Mexico to Tierra del Fuego and includes the Caribbean and Latinx cultures of the United States, the course examines key art movements and discourses across the region through the lens of historical and political events. Includes museum and gallery visits.
Attribute/Distribution: CC, HE, HU, W

LAS 243 (SPAN 243) Indigenous Cultures in Spanish America 4 Credits
A survey of Spanish American narratives that deal with the relationship between indigenous and occidental cultures. While examining works created from the late 19th century up until present day, we analyze the construction of cultural identity in several countries including Bolivia, Ecuador, and Mexico. Analysis will include works of poetry, short story, novel, essay, and film by several influential artists: Clorinda Matto de Turner, Jorge Icaza and José María Arguedas, to name just a few.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

LAS 263 (SPAN 263) The Spanish American Short Story 4 Credits
Comparative study of representative works by major writers such as Quiroga, Borges, and Cortazar, among others.
Attribute/Distribution: CC, HU, W

LAS 265 (FILM 265, SPAN 265) Spanish and Latin American Cinema 4 Credits
An introduction to cinema in the Spanish-speaking world. Oral discussion and written analysis of selected films. Students view films independently.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

LAS 270 (HMS 270, SPAN 270) Spanish for the Health Professions 4 Credits
For prospective medical personnel communicating with Spanish-speaking patients. Healthcare vocabulary, patient-provider interaction, and cultural background of the Latino patient.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU

LAS 291 Special Topics 1-4 Credits
A topic, genre, or approach in literature, history, or social sciences not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

LAS 302 (ENGL 302, GS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including “fantastic” narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: CC, HU

LAS 320 (SPAN 320) Literature of the Spanish Caribbean 4 Credits
Study of representative works with emphasis on Cuba and Puerto Rico. Writers include Barnet, Carpentier, and Rodriguez Juliá.
Attribute/Distribution: CC, HU, W

LAS 325 (SPAN 325) Hispanic Literature of The United States 4 Credits
Discussion of fiction, poetry, drama, and film from the main groups in the U.S. Hispanic population. Discussion of Hispanic ethnic identity, bilingualism, and minority issues.
Attribute/Distribution: CC, HU, W

LAS 326 (SPAN 326, WGSS 326) Tradition and Resistance: Women Writers of Latin America 4 Credits
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, Cristina Peri Rossi, among others.
Prerequisites: SPAN 152
Attribute/Distribution: CC, HU, W

LAS 342 The New Narrative Spanish American Literature 4 Credits
Critical evaluation of distinguished works of Spanish American prose fiction of the 1960’s and 70’s. Readings by Donoso, Fuentes, García Márquez, and Vargas Llosa, among others.
Prerequisites: LAS 152 or SPAN 152
Attribute/Distribution: HU

LAS 345 Testimonial Writing in the Hispanic World 4 Credits
This course explores the genre testimonio, which confronts the official history of the Latin American and Spanish dictatorships and portrays the experiences and struggles of those who suffered political repression. The course focuses on the analysis of both literary and visual testimonios from the Hispanic world, as well as on theoretical issues concerning discourses of truth.
Attribute/Distribution: HU

LAS 350 (ENGL 350) Special Topics in Latino Studies 3-4 Credits
Selected works by Latinx Diaspora writers, poets, and artists. Course engages with an ethnic studies framework and approach to texts in terms of U.S. canon formation with attention to race, class, gender, language, and nationality. No prerequisite.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

LAS 369 (HIST 369) Columbus on Trial: A Critical Reading of the Spanish Conquest 4 Credits
In this seminar students master the history of the Conquest era (roughly, 1490s-1570s) in Spanish America and learn about the origins of colonialism. The course offers an opportunity to read critically some traditional European-centered narratives of the Conquest. It also incorporates the views and voices of Indigenous peoples and Africans. After reading classic primary and secondary sources, students judge for themselves the complex and rather tragic legacy of the encounter between Europeans and the Indigenous peoples of the Americas.
Attribute/Distribution: CC, HE, HU, W

LAS 387 (SPAN 387) Melodrama in Contemporary Spanish American Narrative 4 Credits
From the earliest works of Latin American narrative onward, melodrama has served as a fundamental tool for the structuring of dramatic conflict. Ranging from the programmatic social novel to the most parodic contemporary works, we will carefully examine the aims of melodramatic narration in works by Roberto Arlt and Mario Vargas Llosa, among others, as well as in various films and telenovelas.
Attribute/Distribution: CC, HU, W

LAS 391 Melodrama in Contemporary Spanish American Narrative 4 Credits
From the earliest works of Latin American narrative onward, melodrama has served as a fundamental tool for the structuring of dramatic conflict. Ranging from the programmatic social novel to the most parodic contemporary works, we will carefully examine the aims of melodramatic narration in works by Roberto Arlt and Mario Vargas Llosa, among others, as well as in various films and telenovelas.
Attribute/Distribution: HU

LAS 392 (SPAN 392) The City and the Country in Spanish American Narrative 4 Credits
Across the history of the region defined as Latin America, urbanization, on the one hand, and the isolation of national interiors, on the other, have contributed to a problematic relationship between the city and the country. In examining works by the likes of Roberto Arlt, José Donoso, and Mario Bellatin, among others, this course examines the dialogue between the ostensibly separate environs of city and country, and questions they ways in which they influence one another.
Attribute/Distribution: CC, HU, W

LAS 393 (SPAN 393) The Boom and Beyond 4 Credits
This class will examine works from the so-called Boom of Spanish American literature in the 1960s alongside texts produced following this crucial moment of artistic and social change throughout Latin America. Moving from the Boom toward the postmodern, we will consider works by Gabriel GarcÃa MÃ¡rquez, Manuel Puig, and Mario Levrero, among others.
Attribute/Distribution: CC, HU, W

LAS 394 Special Topics 1-4 Credits
A topic, genre, or approach in literature, history, or social sciences not covered in other courses. Consent of Program Director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

Mathematics

Mathematics is a subject of great intrinsic power and beauty. It is the universal language of science, and is essential for a clear and complete understanding of virtually all phenomena. Mathematical training prepares a student to express and analyze problems and relationships in a logical manner in a wide variety of disciplines including the physical, engineering, social, biological, and medical sciences, business, and pure mathematics itself. This is a principal reason behind the perpetual need and demand for mathematicians in education, research centers, government, and industry.

The department offers three major programs leading to the degrees of bachelor of arts with major in mathematics, bachelor of science in mathematics, and bachelor of science in statistics. It also offers several minor programs for undergraduates. Students can earn their bachelor and master of education (M.Ed.) degree in elementary education or secondary education plus Pennsylvania teacher certification in 5 years.

At the graduate level, the department offers programs leading to the degrees of master of science in mathematics, master of science in applied mathematics, master of science in statistics, doctor of philosophy in mathematics, and doctor of philosophy in applied mathematics. The department is a part of the interdisciplinary program in analytical finance.

CALCULUS SEQUENCES

Many degree programs throughout the university include a mathematics requirement consisting of a sequence in calculus. The Department of Mathematics offers four calculus sequences:

MATH 021 & MATH 022 & MATH 023	Calculus I and Calculus II and Calculus III	12
MATH 031 & MATH 032 & MATH 033	Honors Calculus I and Honors Calculus II and Honors Calculus III	12
MATH 051 & MATH 052	Survey of Calculus I and Survey of Calculus II	7
MATH 081 & MATH 082	Calculus with Business Applications I and Calculus with Business and Economics Applications II	8

The MATH 021, MATH 022, MATH 023 sequence is a systematic development of calculus. Most students of mathematics, science, and engineering, will take some or all of this sequence.

As an honors sequence, the MATH 031, MATH 032, MATH 033 sequence covers essentially the same material but in greater depth and with more attention to rigor and proof. This sequence should be considered by students who have demonstrated exceptional ability in mathematics.

The MATH 051, MATH 052 sequence is a survey of calculus. This sequence is not sufficient preparation for most subsequent mathematics courses. Students contemplating further study in mathematics should consider MATH 021, MATH 022 instead.

MATH 081, MATH 082 sequence is a survey with business applications. This sequence is not sufficient preparation for most subsequent mathematics courses. Students contemplating further study in mathematics should consider MATH 021, MATH 022 instead. MATH 075, MATH 076 is a two-semester sequence that substitutes for MATH 021, covering the same material but at a slower pace.

The MATH 031, MATH 032, MATH 033 sequence will be accepted in place of MATH 021,MATH 022,MATH 023. MATH 021, MATH 022 will be accepted in place of MATH 051, MATH 052. MATH 021 will be accepted in place of MATH 081. Credit will be awarded for only one course in each of the following groups:

Group 1		
MATH 021	Calculus I	4
MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	4
MATH 031	Honors Calculus I	4
MATH 051	Survey of Calculus I	4
MATH 081	Calculus with Business Applications I	4
Group 2		
MATH 022	Calculus II	4
MATH 032	Honors Calculus II	4
MATH 052	Survey of Calculus II	3
MATH 082	Calculus with Business and Economics Applications II	4
Group 3		
MATH 023	Calculus III	4
MATH 033	Honors Calculus III	4

UNDERGRADUATE DEGREE PROGRAMS

The Department of Mathematics offers degree programs in Mathematics and Statistics. These programs have the flexibility and versatility needed to prepare students for a wide variety of careers in government, industry, research and education.

Students in the degree programs in mathematics must satisfy three types of requirements: Core Mathematics Requirements, Advanced Mathematics Electives and General Electives. The Core Mathematics Requirement ensures a common core of knowledge appropriate for students in each program. The Advanced Mathematics Electives consist of courses with specific mathematical or statistical content chosen by the student in consultation with the major advisor to complement the student's interest and career aspirations. With these further breadth and greater depth of knowledge are achieved. The General Electives consist of additional courses chosen from among those offered by the university faculty. Students can use these electives to pursue interests beyond the major, or may use these to expand upon the basic requirements of the degree program. Students are strongly encouraged to use some of these electives to earn a minor in another discipline.

Students in the degree programs in statistics must satisfy four types of requirements beyond those required by the college: Required Major Courses, Major Electives, Professional Electives and General Electives. The Required Major Courses form the backbone of the program and ensure a common core of knowledge appropriate for students in the programs. The Major Electives consist of courses with specific mathematical or statistical content chosen by the student in consultation with the major advisor to complement the student's interest. The Professional Electives are meant for the students to develop their knowledge in some disciplines of applications of statistics. These can be broadly chosen in consultation with an advisor in a way that is consistent with each student's career aspirations.

Each student is provided a faculty advisor to guide an individual program and supervise the selection of electives.

B.A. WITH A MAJOR IN MATHEMATICS

The B.A. program in mathematics emphasizes fundamental principles as well as the mastery of techniques required for the effective use of mathematics. The program provides a solid foundation for those who want to pursue a mathematically oriented career or advanced study in any mathematically oriented field.

Requirements

Calculus requirement:		**12**
MATH 021 & MATH 022 & MATH 023	Calculus I and Calculus II and Calculus III	
Core Requirements		**15**
MATH 163	Introduction to Mathematical Reasoning	3
MATH 242	Linear Algebra	3-4
MATH 243	Algebra	3,4
MATH 301	Principles of Analysis I	3-4
Advanced Mathematics Electives		**15-20**
At least five courses (minimum of 15 credits) from the approved list; at least one of these must be at the 300 level; at most one course may be taken outside the department; chosen in consultation with major advisor.		
Total Credits		**42-47**

The Writing Intensive requirement is achieved by MATH 243 and MATH 301.

A student must achieve an average of 2.0 or higher in major courses.

B.S. IN MATHEMATICS

The BS in Mathematics program provides a more extensive and intensive study of mathematics and its applications. This program is especially recommended for students intending to pursue advanced study in mathematics, applied mathematics, or closely related fields.

Requirements

Calculus Requirement		**12**
MATH 021 & MATH 022 & MATH 023	Calculus I and Calculus II and Calculus III	
Core Requirements		**15**
MATH 163	Introduction to Mathematical Reasoning	3
MATH 242	Linear Algebra	3-4
MATH 243	Algebra	3-4
MATH 301	Principles of Analysis I	3-4
Advanced Mathematics Electives		**24-32**
At least eight courses (minimum of 24 credits) from the approved list; at least four of these must be at the 300 level; at most two courses may be taken outside the department; chosen in consultation with major advisor.		
Two approved(*) CSE courses. (*)Computer sciences courses must include a programming component. They are approved by the major advisor. The CSE requirement is waived for students with a minor in Computer Science.		5-6
Total Credits		**56-65**

The Writing Intensive requirement is achieved by MATH 243 and MATH 301.

A student must achieve an average of 2.0 or higher in major courses.

List of approved Advanced Mathematics electives:

The list of Advanced Mathematics electives (ADV List) consists of the following courses:

- MATH 208, MATH 229, MATH 230, MATH 234, MATH 252, MATH 263, MATH 264;
- All 300 level courses offered by the Mathematics Department except MATH 301 (required core course), MATH 371 (see below), MATH 381 (see below), and MATH 391 (see below);
- Notes:
  - Together, MATH 202 *and* MATH 203 (as a three credit combination), is accepted as *one* Advanced Mathematics elective;
  - With prior approval, *one* Advanced Mathematics elective (3 credits) may be replaced with three credits of (a combination of) MATH 271(Readings), MATH 371(Readings), MATH 291 or MATH 381 (Undergraduate Research), or MATH 391(Senior Thesis) completed over one or two semesters;
  - All 400 level courses are accepted as Advanced Mathematics electives. (Note. To enroll in a 400 level course, an undergraduate must successfully petition the appropriate university committee.)

Suggested Concentrations:

Applied Mathematical Modeling Concentration: This concentration should be considered by students interested in graduate study in applied mathematics or computational mathematics. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

- MATH 230
- MATH 319
- At least *two* courses selected from: MATH 320, MATH 322, MATH 323, MATH 341
- At least *two* additional courses selected from:
  - MATH 202/203, MATH 208, MATH 263, MATH 264, MATH 252
  - MATH 305, MATH 306, MATH 309, MATH 310, MATH 311, MATH 312, MATH 320, MATH 322, MATH 323, MATH 334, MATH 338, MATH 340, MATH 341, MATH 343
- At least *two* additional courses selected from the list of approved Advanced Mathematics Electives (see ADV List below)
- At least *four* of these courses must be at the 300 level.

Probability and Statistics Concentration: This concentration should be considered by students interested in actuarial science. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

- MATH 263
- MATH 264
- At least *two* courses selected from: MATH 310, MATH 312, MATH 334, MATH 338
- At least *two* additional courses selected from:
  - MATH 202/203, MATH 208, MATH 252,
  - MATH 305, MATH 306, MATH 309, MATH 310, MATH 311, MATH 312, MATH 320, MATH 322, MATH 323, MATH 334, MATH 338, MATH 340, MATH 341, MATH 343
- At least *two* additional courses selected from the list of approved Advanced Mathematics Electives (see ADV List below)
- At least *four* of these courses must be at the 300 level.

Theoretical Mathematics Concentration: This concentration should be considered by students interested in graduate study in mathematics or applied mathematics. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

- MATH 327
- MATH 302 or MATH 316
- At least *two* additional courses selected from: MATH 302, MATH 305, MATH 307, MATH 311, MATH 316, MATH 319, MATH 331, MATH 342
- At least *four* additional courses selected, in consultation with the major advisor, from the list of approved Advanced Mathematics Electives (see ADV List below)
- At least *four* of these courses must be at the 300 level.

Other concentration: Students, in consultation with the major advisor, may design their own concentration by selecting a coherent list of eight Advanced Mathematics electives from the list of approved courses (see ADV List above). For instance, this option should be considered by students with an interest in data science, computer science, or mathematical economics.

B.A. WITH A MAJOR IN STATISTICS

The B.A. program in statistics emphasizes fundamental principles for designing the process of data collection, for summarizing and interpreting data, and for drawing valid conclusions from data. The B.A. program provides a sufficient foundation for those who want to

pursue a career in a field of applications of statistics and is flexible enough to be combined as a double major.

Required Major course

MATH 021	Calculus I	4
or MATH 051	Survey of Calculus I	
or MATH 081	Calculus with Business Applications I	
MATH 022	Calculus II	3-4
or MATH 052	Survey of Calculus II	
or MATH 082	Calculus with Business and Economics Applications II	
MATH 264	Introduction to Statistical Reasoning and Methods	4
Select one of the following (+):		4
MATH 205	Linear Methods	
MATH 241	Applied Linear Algebra	
MATH 242	Linear Algebra	

(+) MATH 241 is recommended. For students who may need more preparation, MATH 205 can be used as a major elective.

MATH 263	Introduction to the Theory of Probability	3
or MATH 309	Probability with Applications and Simulations	

Advanced Statistics Electives

Select three (3) of the following:		9-12
MATH 310	Random Processes and Applications	
MATH 312	Statistical Computing and Applications	
MATH 334	Mathematical Statistics	
MATH 338	Statistical Models in Data Science	
MATH 339	Time Series and Forecasting	
MATH 365	Statistical Machine Learning	
MATH 374	Statistical Project	3
Two approved (*) CSE courses.		5-7

(*) Computer sciences courses must include a programming component. They are approved by the major advisor. The CSE requirement is waived for students with a major or minor in Computer Science.

Professional Electives

Courses selected from a field of application of statistics and probability with the approval of the faculty advisor (#)	6

(#) Courses taken as part of a second major or a minor can be used as professional electives.

Total Credits	**41-47**

The Writing Intensive requirement is achieved by MATH 374.

B.S. IN STATISTICS

Statistics provides a body of principles for designing the process of data collection, for summarizing and interpreting data, and for drawing valid conclusions from data. It thus forms a fundamental tool in the natural and social sciences as well as business, medicine, and other areas of research. Mathematical principles, especially probability theory, underlie all statistical analyses. The B.S. program in Statistics provides students with a comprehensive study of the field of statistics. The standard track covers both the mathematical foundations of the discipline, as well as its applied aspect and its practical use. The applied track focuses on the latter. This program is especially recommended for students intending to pursue a career as a statistician, advanced studies in statistics, data science, or related fields.

The BS in Statistics program offers two tracks: the standard track and the applied track.

STANDARD TRACK

Required Major courses

MATH 021	Calculus I	4
or MATH 051	Survey of Calculus I	
or MATH 081	Calculus with Business Applications I	
MATH 022	Calculus II	3-4
or MATH 052	Survey of Calculus II	
or MATH 082	Calculus with Business and Economics Applications II	
MATH 264	Introduction to Statistical Reasoning and Methods	4
Select one of the following (+):		3-4
MATH 205	Linear Methods	
MATH 241/ STAT 342	Applied Linear Algebra	
MATH 242	Linear Algebra	

(+) MATH 241 is recommended. For students who may need more preparation, MATH 205 can be used as a major elective.

MATH 263	Introduction to the Theory of Probability	3
or MATH 309	Probability with Applications and Simulations	
MATH 310	Random Processes and Applications	3-4
MATH 312	Statistical Computing and Applications	3-4
MATH 334	Mathematical Statistics	3-4
MATH 338	Statistical Models in Data Science	3-4
MATH 365	Statistical Machine Learning	3-4
MATH 374	Statistical Project	3
Two approved (*) CSE courses.		5-7

(*) Computer sciences courses must include a programming component. They are approved by the major advisor. The CSE requirement is waived for students with a minor in Computer Science.

Major Electives

At least two courses with specific mathematical or statistical content chosen with the approval of the faculty advisor	8

Professional Electives

Courses selected from two or three fields of application of statistics and probability with the approval of the faculty advisor (#)	15

(#) Courses taken as part of a minor can be used as professional electives.

Total Credits	**63-72**

The Writing Intensive requirement is achieved by MATH 374.

APPLIED TRACK

Required Major courses

MATH 021	Calculus I	4
or MATH 051	Survey of Calculus I	
or MATH 081	Calculus with Business Applications I	
MATH 022	Calculus II	3-4
or MATH 052	Survey of Calculus II	
or MATH 082	Calculus with Business and Economics Applications II	
MATH 264	Introduction to Statistical Reasoning and Methods	4
Select one of the following (+):		3-4
MATH 205	Linear Methods	
MATH 241/ STAT 342	Applied Linear Algebra	
MATH 242	Linear Algebra	

(+) MATH 241 is recommended. For students who may need more preparation, MATH 205 can be used as a major elective.

MATH 309	Probability with Applications and Simulations	3
MATH 312	Statistical Computing and Applications	3-4
MATH 334	Mathematical Statistics	3-4
MATH 339	Time Series and Forecasting	3-4
MATH 365	Statistical Machine Learning	3-4
MATH 374	Statistical Project	3
Two approved (*) CSE courses.		5-7

(*) Computer sciences courses must include a programming component. They are approved by the major advisor. The CSE requirement is waived for students with a minor in Computer Science.

Major Electives	
At least three courses with specific mathematical or statistical content chosen with the approval of the faculty advisor	12
Professional Electives	
Courses selected from two or three fields of application of statistics and probability with the approval of the faculty advisor (#)	15

(#) Courses taken as part of a minor can be used as professional electives.

Total Credits	**64-72**

The Writing Intensive requirement is achieved by MATH 374.

CONCENTRATION IN ACTUARIAL SCIENCE

Major Electives must include:

MATH 202	Actuarial Exam I	1
MATH 203	Actuarial Exam II - Financial Mathematics	2

Professional Electives (15 credit hours) must include at least three of these courses:

ACCT 151	Introduction to Financial Accounting	3
ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
FIN 125	Introduction to Finance	3

DEPARTMENTAL HONORS

Students may earn departmental honors by writing a thesis during their senior year. Students are accepted into the program during their junior year by the department chairperson. This acceptance is based upon the student's grades and a thesis proposal, which the student must prepare in conjunction with a thesis advisor selected by the student. An oral presentation as well as a written thesis are required for completion of the program.

MINOR PROGRAMS

The department offers minor programs in different branches of the mathematical sciences. The requirement consists of a Calculus course (MATH 023 or MATH 033 or MATH 052 or MATH 082 depending on the minor) and four additional courses shown below for each of the programs. At most one of the five courses in the minor program may also be required in the major program or another minor. For substitutions, the student should consult the chairperson.

Minor in Pure Mathematics

MATH 023	Calculus III	4
MATH 242	Linear Algebra	3-4
MATH 243	Algebra	3-4
MATH 301	Principles of Analysis I	3-4
Select one of the following:		3-4
MATH 302	Course MATH 302 Not Found	
MATH 303	Course MATH 303 Not Found	
MATH 307	General Topology I	
MATH 316	Complex Analysis	
MATH 319	Introduction to Differential Equations	
MATH 320	Ordinary Differential Equations	
MATH 327	Groups and Rings	
MATH 331	Differential Geometry of Curves and Surfaces	
MATH 342	Number Theory	
Total Credits		**16-20**

Minor in Applied Mathematics

MATH 023	Calculus III	4
MATH 341	Mathematical Models and Their Formulation	3
Select three of the following:		9-10
MATH 205	Linear Methods	
MATH 208	Complex Variables	
MATH 230	Numerical Methods	
MATH 231	Probability and Statistics	
MATH 241	Applied Linear Algebra	
MATH 242	Linear Algebra	
MATH 263	Introduction to the Theory of Probability	
MATH 264	Introduction to Statistical Reasoning and Methods	
MATH 319	Introduction to Differential Equations	
MATH 320	Ordinary Differential Equations	
MATH 322	Methods of Applied Analysis I	
MATH 323	Methods of Applied Analysis II	
Total Credits		**16-17**

Minor in Probability and Statistics

MATH 023	Calculus III	4
or MATH 052	Survey of Calculus II	
or MATH 082	Calculus with Business and Economics Applications II	
MATH 263	Introduction to the Theory of Probability	3
or MATH 309	Probability with Applications and Simulations	
Select one of the following:		3-4
MATH 012	Basic Statistics and Data Science	
MATH 231	Probability and Statistics	
MATH 264	Introduction to Statistical Reasoning and Methods	
Select two of the following:		6-8
MATH 310	Random Processes and Applications	
MATH 312	Statistical Computing and Applications	
MATH 334	Mathematical Statistics	
MATH 338	Statistical Models in Data Science	
MATH 339	Time Series and Forecasting	
MATH 365	Statistical Machine Learning	
Total Credits		**16-19**

Minor in Actuarial Science

MATH 023	Calculus III	3-4
or MATH 052	Survey of Calculus II	
or MATH 082	Calculus with Business and Economics Applications II	
MATH 263	Introduction to the Theory of Probability	3
or MATH 309	Probability with Applications and Simulations	
MATH 310	Random Processes and Applications	3-4
MATH 202	Actuarial Exam I	1
MATH 203	Actuarial Exam II - Financial Mathematics	2
Select one of the following:		3
ACCT 108	Fundamentals of Accounting	
ACCT 151	Introduction to Financial Accounting	
ECO 119	Intermediate Macroeconomic Analysis	
ECO 146	Intermediate Microeconomic Analysis	
Total Credits		**15-17**

For information on examinations of actuarial societies, students may consult their minor advisor.

GRADUATE PROGRAMS IN MATHEMATICS

The department offers graduate programs leading to the degrees of master of science in mathematics, applied mathematics, or statistics, and the doctor of philosophy in mathematics or applied mathematics.

The Department does not offer a doctorate in statistics. However, students may choose statistics or mathematical statistics as a concentration in the doctor of philosophy programs in mathematics and applied mathematics. The Department is a part of the interdisciplinary program in Financial Engineering. For details on the Master of Science in Financial Engineering, see the Interdisciplinary Graduate Study and Research, Financial Engineering section.

To begin graduate work in mathematics a student must present evidence of adequate undergraduate preparation. The undergraduate program should have included a year of advanced calculus, a semester of linear algebra, and a semester of abstract algebra.

M.S. in Mathematics or Applied Mathematics

The master's program requires 30 credit hours of graduate courses with at least 18 credit hours at the 400 level. With the permission of the chairperson, up to six credit hours of these courses can be replaced by a thesis. All students in the master's program must also pass a comprehensive examination. The M.S. degree can serve both as a final degree in mathematics or as an appropriate background for the Ph.D. degree.

M.S. in Statistics

This program requires 30 credit hours of graduate courses with at least 18 hours of 400-level STAT or MATH courses. The choice of courses must be approved by the graduate advisor, and up to six hours of coursework may be replaced with a thesis. All students in the program must also pass a comprehensive examination.

The M.S. program in statistics has two tracks:

statistics track

The statistics track has recommended courses:

MATH 309	Probability with Applications and Simulations	3
MATH 312	Statistical Computing and Applications	3-4
STAT 342	Applied Linear Algebra	3
STAT 410	Random Processes and Applications	3
STAT 434	Mathematical Statistics	3
STAT 438	Statistical Models in Data Science	3
STAT 471	Topics in Statistical Learning and Computing	3
Electives		
STAT 412	Advanced Applied Statistics	3
Select two other possible electives:		6
STAT 408	Seminar in Statistics and Probability	
STAT 409	Seminar in Statistics and Probability	
STAT 439	Time Series and Forecasting	
STAT 461	Topics In Mathematical Statistics	
STAT 465	Statistical Machine Learning	
STAT 474	Statistical Practice	
MATH 462	Modern Nonparametric Methods in Statistics	
ISE 332	Product Quality	
ISE 409	Time Series Analysis	
ISE 410	Design of Experiments	
ECO 460	Time Series Analysis	
ECO 463	Topics in Game Theory	
CSE 326	Fundamentals of Machine Learning	
or ISE 364	Introduction to Machine Learning	
CSE 347	Data Mining	
or ISE 365	Applied Data Mining	
Total Credits		**30-31**

stochastic modeling track

The stochastic modeling track has recommended courses:

MATH 309	Probability with Applications and Simulations	3
MATH 401	Real Analysis I	3
STAT 342	Applied Linear Algebra	3
STAT 410	Random Processes and Applications	3
STAT 463	Advanced Probability	3
Electives		
MATH 341	Mathematical Models and Their Formulation	3
STAT 434	Mathematical Statistics	3
STAT 438	Statistical Models in Data Science	3
STAT 464	Advanced Stochastic Processes	3
Select one other possible electives:		3
STAT 408	Seminar in Statistics and Probability	
STAT 409	Seminar in Statistics and Probability	
STAT 439	Time Series and Forecasting	
STAT 465	Statistical Machine Learning	
STAT 471	Topics in Statistical Learning and Computing	
STAT 474	Statistical Practice	
MATH 402	Real Analysis II	
MATH 430	Numerical Analysis	
MATH 467	Stochastic Calculus	
MATH 468	Financial Stochastic Analysis	
ECO 463	Topics in Game Theory	
CSE 411	Advanced Programming Techniques	
ISE 339	Stochastic Models and Applications	
ISE 409	Time Series Analysis	
ISE 416	Dynamic Programming	
ISE 439	Stochastic Models and Applications	
Total Credits		**30**

Ph.D. in Mathematics

The plan of work toward the doctor of philosophy degree will include a comprehensive examination, a qualifying examination, and an advanced topic examination. A language exam may be required at the discretion of the doctoral committee. The qualifying examination tests the student’s command of algebra and real analysis. The content of the advanced topic examination is determined by a department committee. A general examination, the doctoral dissertation and its defense complete the work for the Ph.D. degree.

Each candidate's plan of work must be approved by a special committee of the department. A Ph.D. student is required to have 18 credits of approved graduate level course work beyond the master's level. Successful completion of MATH 316 and MATH 307 is required of all students. After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409 and MATH 499.

Mathematics, PhD

MATH 307	General Topology I
MATH 316	Complex Analysis
MATH 400-499 [1, 2, 3]	

1

A Ph.D. student is required to have 18 credits of approved graduate level course work beyond the master's level.

2

After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409 and MATH 499

3

Each candidate's plan of work must be approved by a special committee of the department.

Ph.D. in Applied Mathematics

The plan of work toward the doctor of philosophy degree will include a comprehensive examination, a qualifying examination, and an advanced topic examination. A language examination may be required at the discretion of the doctoral committee. The *Ph.D. in Applied Mathematics* qualifying examination tests the student's command of *Statistics and Applied Probability* or of *Real Analysis and Differential Equations*. The content of the advanced topic examination is determined by a department committee. A general examination, the doctoral dissertation and its defense complete the work for the Ph.D. degree.

Each candidate's plan of work must be approved by a special committee of the department. A Ph.D. student is required to have 18 credits of approved graduate level course work beyond the master's level. After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409 and MATH 499.

MATH Coursework [1, 2, 3]

1

A Ph.D. student is required to have 18 credits of approved graduate level course work beyond the master's level.

2

After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409 and MATH 499.

3

Each candidate's plan of work must be approved by a special committee of the department.

Mathematics Courses

MATH 000 Preparation for Calculus 0,2 Credits
Intensive review of fundamental concepts in mathematics utilized in calculus, including functions and graphs, exponentials and logarithms, and trigonometry. This course is for students who need to take MATH 51, 81, or 21, but who require additional preparation in precalculus. The credits for this course do not count toward graduation, but do count toward GPA and current credit count. Consent of department.
Attribute/Distribution: MA

MATH 005 Introduction to Mathematical Thought 3 Credits
Meaning, content, and methods of mathematical thought illustrated by topics that may be chosen from number theory, abstract algebra, combinatorics, finite or nonEuclidean geometries, game theory, mathematical logic, set theory, topology.
Attribute/Distribution: MA, Q

MATH 009 Introduction to Finite Mathematics 4 Credits
Systems of linear equations, matrices, introduction to linear programming. Sets, counting methods, probability, random variables, introduction to Markov chains.
Attribute/Distribution: MA, Q

MATH 012 Basic Statistics and Data Science 0,4 Credits
A first course in the basic concepts and methods of statistics with illustrations from the social, behavioral, and biological sciences. Descriptive statistics; frequency distributions, mean and standard deviation, two-way tables, correlation and regression; random sampling, rules of probability, probability distributions and parameters, parameter estimation, confidence intervals, hypothesis testing, statistical significance. Note: Mathematics and Statistics majors may not receive credit for both MATH 012 & ECO 045.
Attribute/Distribution: MA, Q

MATH 014 (PHIL 014) Symbolic Logic 4 Credits
This course is an introduction to logical theory. Our primary goal is to study the notions of logical consequence and provability. The central question that we will try to answer is this: What exactly does it mean to say that some conclusion is a logical consequence of or is provable from a certain collection of premises? To answer this question as clearly and rigorously as possible, we will develop three symbolic logical systems: Term Logic, Sentence Logic, and Predicate Logic.
Attribute/Distribution: MA, Q

MATH 021 Calculus I 0,4 Credits
Functions and graphs; limits and continuity; derivative, differential, and applications; indefinite and definite integrals; trigonometric, logarithmic, exponential, and hyperbolic functions. Students may not obtain credit for more than one of Math021, Math031, Math051, (Math075 and Math076), Math081. However all graded courses will still be factored into the GPA.
Attribute/Distribution: MA, Q

MATH 022 Calculus II 0,4 Credits
Applications of integration; techniques of integration; separable differential equations; infinite sequences and series; Taylor's Theorem and other approximations; curves and vectors in the plane. Students may not obtain credit for more than one of Math022, Math032, Math052, Math082. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 021 or MATH 076
Attribute/Distribution: MA, Q

MATH 023 Calculus III 0,4 Credits
Vectors in space; partial derivatives; Lagrange multipliers; multiple integrals; vector analysis; line integrals; Green's Theorem, Gauss's Theorem. Students may not obtain credit for more than one of MATH 023, MATH 033. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 022
Attribute/Distribution: MA, Q

MATH 031 Honors Calculus I 4 Credits
Same topics as in MATH 021, but taught from a more thorough and rigorous point of view. Students may not obtain credit for more than one of MATH 021, MATH 031, MATH 051, (MATH 075 and MATH 076), MATH 081. However all graded courses will still be factored into the GPA.
Attribute/Distribution: MA, Q

MATH 032 Honors Calculus II 4 Credits
Same topics as in MATH 022, but taught from a more thorough and rigorous point of view. Students may not obtain credit for more than one of Math022, Math032, Math052, Math082. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 031 or MATH 021
Attribute/Distribution: MA, Q

MATH 033 Honors Calculus III 0,4 Credits
Same topics as in MATH 023, but taught from a more thorough and rigorous point of view. Students may not obtain credit for more than one of Math023, Math033. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 022 or MATH 032
Attribute/Distribution: MA, Q

MATH 043 Survey of Linear Algebra 3 Credits
Matrices, vectors, vector spaces and mathematical systems, special kinds of matrices, elementary matrix transformations, systems of linear equations, convex sets, introduction to linear programming.
Attribute/Distribution: MA, Q

MATH 051 Survey of Calculus I 0,4 Credits
Limits. The derivative and applications to extrema, approximation, and related rates. Exponential and logarithm functions, growth and decay. Integration. Trigonometric functions and related derivatives and integrals. Students may not obtain credit for more than one of Math021, Math031, Math051, (Math075 and Math076), Math081. However all graded courses will still be factored into the GPA.
Attribute/Distribution: MA, Q

MATH 052 Survey of Calculus II 3 Credits
Techniques of integration. Differential equations. Probability and calculus. Partial derivatives and extrema. Multiple integrals and applications. Students may not obtain credit for more than one of Math022, Math032, Math052, Math082. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 051 or MATH 021 or MATH 031 or MATH 076 or MATH 081
Attribute/Distribution: MA, Q

MATH 075 Calculus I, Part A 2 Credits
Covers the same material as the first half of MATH 021. Meets three hours per week, allowing more class time for each topic than does MATH 021. Students may not obtain credit for more than one of Math021, Math031, Math051, (Math075 and Math076), Math081. However all graded courses will still be factored into the GPA.
Attribute/Distribution: MA, Q

MATH 076 Calculus I, Part B 2 Credits
Continuation of MATH 075, covering the second half of MATH 021. Meets three hours per week. Students may not obtain credit for more than one of Math021, Math031, Math051, (Math075 and Math076), Math081. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 075
Attribute/Distribution: MA, Q

MATH 081 Calculus with Business Applications I 0,4 Credits
Limits and continuity; exponential, logarithmic and trigonometric functions; derivatives; extrema; approximations; indefinite and definite integrals. Applications with emphasis on business and economics. Students may not obtain credit for more than one of Math021, Math031, Math051, (Math075 and Math076), Math081. However all graded courses will still be factored into the GPA.
Attribute/Distribution: MA, Q

MATH 082 Calculus with Business and Economics Applications II 0,4 Credits
Integration by parts, partial fractions, Riemann sums; differential equations; series; Taylor series. Vectors, inner products and projections; functions of several variables, partial derivatives. Multiple integrals; vector-valued functions. Applications with emphasis on finance and economics. Students may not obtain credit for more than one of Math022, Math032, Math052, Math082. However all graded courses will still be factored into the GPA.
Prerequisites: MATH 081 or MATH 021 or MATH 031 or MATH 076 or MATH 051
Attribute/Distribution: MA, Q

MATH 114 (PHIL 114) Metalogic 4 Credits
This is a course on the metatheory of First-Order Predicate Logic. It offers expositions of some of the most important results of this metatheory, such as the Soundness and Completeness Theorems, Gödel's first and second Incompleteness Theorems, Tarski's Indefinability Theorem, and Church's Undecidability Theorem. It also offers introductory expositions of set theory, computability theory, and Second-Order Predicate Logic. The course is structured to serve the needs of a mixed audience, including students with no background in symbolic logic.
Attribute/Distribution: MA, Q

MATH 130 (BIOS 130) Biostatistics 0,4 Credits
Elements of statistics and probability with emphasis on biological applications. Statistical analysis of experimental and observational data.
Prerequisites: MATH 052 or MATH 022 or MATH 032
Attribute/Distribution: Q

MATH 163 Introduction to Mathematical Reasoning 3 Credits
An introduction to the discipline of mathematics for students considering a major in mathematics. Provides an introduction to rigorous mathematical reasoning, including basic proof techniques (e.g., basic propositional calculus, induction, contradiction) and key concepts which recur throughout mathematics (e.g., universal and existential quantifiers, equivalence classes, basic set theory). Students majoring in mathematics should complete this course before MATH 242, MATH 243 or MATH 301 and are encouraged to complete this course in the first or second year of study.
Prerequisites: MATH 021
Attribute/Distribution: Q

MATH 171 Readings 1-3 Credits
Study of a topic in mathematics under individual supervision. Intended for students with specific interests in areas not covered in the listed courses. Consent of department chair required.
Attribute/Distribution: MA

MATH 201 Problem Solving 1 Credit
Practice in solving challenging mathematics problems using a variety of techniques. Permission of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 202 Actuarial Exam I 1 Credit
Preparation for the first actuarial exam – probability. Problems in calculus and probability with insurance applications.
Prerequisites: (MATH 023 or MATH 052 or MATH 082) and (MATH 231 or MATH 263 or MATH 309)
Attribute/Distribution: Q

MATH 203 Actuarial Exam II - Financial Mathematics 2 Credits
Preparation for the second actuarial exam - financial mathematics. Mathematics of interest and investments, interest rate measurement, present value, annuities, loan repayment schemes, bond valuation, introduction to derivative securities. Practice in solving problems from past exams.
Prerequisites: MATH 022 or MATH 052 or MATH 082
Attribute/Distribution: MA, Q

MATH 205 Linear Methods 3 Credits
Linear differential equations and applications; matrices and systems of linear equations; vector spaces; eigenvalues and application to linear systems of differential equations.
Prerequisites: MATH 022 or MATH 082
Attribute/Distribution: Q

MATH 208 Complex Variables 3 Credits
Functions of a complex variable; calculus of residues; contour integration; applications to conformal mapping and Laplace transforms.
Prerequisites: MATH 023
Attribute/Distribution: Q

MATH 214 (PHIL 214) Topics in Philosophical Logic 4 Credits
Topics may include the many systems of non-classical logic, truth theory, the impact of incompleteness and undecidability results on philosophy, the foundational projects of various philosophers/mathematicians, or the work of an important figure in the history of philosophical logic. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 229 Geometry 3-4 Credits
Discussion of geometry as an axiomatic system. Euclid's postulates. History of and equivalent versions of Euclid's fifth postulate. Finite projective geometries. NonEuclidean geometries based upon negation of the fifth postulate: Geometry on the sphere; Hyperbolic and elliptic geometries. Examination of the concepts of "straight", angle, parallel, symmetry and duality in each of these geometries. Applications of the different geometries will be considered.
Attribute/Distribution: MA, Q

MATH 230 Numerical Methods 3 Credits
Representation of numbers and rounding error; polynomial and spline interpolation; numerical differentiation and integration; numerical solution of nonlinear systems; numerical solution of initial and boundary value problems; Monte Carlo methods. Knowledge of MATLAB or PYTHON or C required.
Prerequisites: MATH 205 or MATH 241 or MATH 242
Attribute/Distribution: Q

MATH 231 Probability and Statistics 3 Credits
Probability and distribution of random variables; populations and random sampling; chi-square and t distributions; estimation and tests of hypotheses; correlation and regression theory of two variables. Not available for credit to students who have completed both MATH 263 and MATH 264.
Prerequisites: MATH 022 or MATH 052 or MATH 082
Attribute/Distribution: Q

MATH 234 Fractal Geometry 3 Credits
Metric spaces and iterated function systems; various types of fractal dimension; Julia and Mandelbrot sets. Other topics such as chaos may be included. Small amount of computer use.
Prerequisites: MATH 023
Attribute/Distribution: Q

MATH 241 Applied Linear Algebra 3,4 Credits
The theoretical basis for applying linear algebra in other fields, including statistics. Topics will include systems of equations, vector spaces, matrices, and linear transformations. Additional topics will include matrix factorizations (including LU, QR, eigen-decomposition, and SVD) and how they can be used in computer analysis of data sets. Not available for credit to students who have completed MATH 242 or STAT 342.
Prerequisites: MATH 022 or MATH 082
Attribute/Distribution: Q

MATH 242 Linear Algebra 3-4 Credits
An introduction to the study of vector spaces and linear transformations, with emphasis on mathematical rigor. Not available for credit to students who have completed MATH 241 / STAT 342.
Prerequisites: MATH 022 and MATH 163
Attribute/Distribution: Q

MATH 243 Algebra 3,4 Credits
Introduction to basic concepts of modern algebra: groups, rings, and fields.
Prerequisites: MATH 242
Attribute/Distribution: Q

MATH 252 Introduction to Combinatorics and Graph Theory 3 Credits
Topics in combinatorics and graph theory chosen to introduce the subjects and some of their common proof techniques. Sequences and recursive formulas; counting formulas; bijections; inclusion/exclusion; the Pigeonhole Principle; generating functions; equivalence relations. Graph theory topics include trees, connectivity, traversability, matching and coloring. Not available for credit to students who have completed MATH 305.
Prerequisites: MATH 022
Attribute/Distribution: Q

MATH 261 (CSE 261) Discrete Structures 3 Credits
Topics in discrete mathematical structures chosen for their applicability to computer science and engineering. Sets, propositions, induction, recursion; combinatorics; binary relations and functions; ordering, lattices and Boolean algebra; graphs and trees; groups and homomorphisms.
Prerequisites: MATH 021 or MATH 076

MATH 263 Introduction to the Theory of Probability 3 Credits
An introduction to the basics of Calculus-based theory of Probability. Includes combinatorial techniques, events, independence, and conditional probability; discrete and continuous probability distributions, expectation and variance; joint distributions and covariance; moment generating functions; basic form of the Laws of Large Numbers and the Central Limit Theorem. Prior knowledge of Probability not required. Not available for credit to students who have completed (MATH 231 and MATH 264) or MATH 309. Cannot be taken concurrently to MATH 309.
Prerequisites: MATH 023 or MATH 052 or MATH 082
Can be taken Concurrently: MATH 023
Attribute/Distribution: Q

MATH 264 Introduction to Statistical Reasoning and Methods 0,4 Credits
Introduction to the basic concepts, logic and issues involved in statistical reasoning and statistical methods used to analyze data and evaluate studies. Topics include descriptive statistics and exploratory data analysis, and basic concepts of machine learning; elementary probability and statistical inference. Examples drawn from various areas of application. Use of computer software (e.g., Minitab, R) to facilitate understanding and to complete data analysis. Not available for credit to students who have completed both MATH 231 and MATH 263.
Prerequisites: MATH 021 or MATH 051 or MATH 081
Attribute/Distribution: Q

MATH 271 Readings 1-3 Credits
Study of a topic in mathematics under individual supervision. Intended for students with specific interests in areas not covered in the listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 291 Undergraduate Research 1-4 Credits
Research in mathematics or statistics under the direction of a faculty member. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q

MATH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

MATH 301 Principles of Analysis I 3-4 Credits
Existence of limits, continuity and uniform continuity; HeineBorel Theorem; existence of extreme values; mean value theorem and applications; conditions for the existence of the Riemann integral; absolute and uniform convergence; emphasis on theoretical material from the calculus of one variable.
Prerequisites: MATH 023
Attribute/Distribution: Q, W

MATH 305 Enumerative Combinatorics 3 Credits
An introduction to basic theoretical results and techniques of enumerative combinatorics such as combinatorial identities, generating functions, inclusion/exclusion, recurrence relations, bijective proofs and permutations. Additional topics will be covered as time permits.
Prerequisites: MATH 242
Attribute/Distribution: Q

MATH 307 General Topology I 3-4 Credits
An introductory study of topological spaces, including metric spaces, separation and countability axioms, connectedness, compactness, product spaces, quotient spaces, function spaces.
Prerequisites: MATH 301
Attribute/Distribution: MA, Q

MATH 309 Probability with Applications and Simulations 3 Credits
Foundations of Probability; Random Variables; Probability Models; Expectations and Moment Generating Functions; Joint and Conditional Distributions; Functions of Random Variables. Introduction to fundamental ideas and techniques of stochastic modeling, with an emphasis on the applications. The last part of the course is devoted to techniques and methods of Monte Carlo simulation. R or other software will be used in this course.
Prerequisites: MATH 023 or MATH 052 or MATH 082
Can be taken Concurrently: MATH 023
Attribute/Distribution: Q

MATH 310 Random Processes and Applications 3-4 Credits
Theory and applications of stochastic processes. Limit theorems, introduction to random walks, Markov chains, Poisson processes, birth and death processes, and Brownian motion. Applications to financial mathematics, biology, business and engineering.
Prerequisites: MATH 263 or MATH 309 or (MATH 231 and (MATH 205 or MATH 241),)
Attribute/Distribution: Q

MATH 311 Graph Theory 3 Credits
An introduction to basic theoretical results and techniques of graph theory such as trees, connectivity, matchings, coloring, planar graphs and Hamiltonicity. Additional topics will be covered as time permits.
Prerequisites: MATH 163 or MATH 252 or CSE 140
Attribute/Distribution: Q

MATH 312 Statistical Computing and Applications 3,4 Credits
Use of statistical computing packages; exploratory data analysis; Monte Carlo methods; randomization and resampling, application and interpretation of a variety of statistical methods in real world problems.
Prerequisites: MATH 012 or MATH 231 or MATH 264 or ECO 045
Attribute/Distribution: Q

MATH 316 Complex Analysis 3-4 Credits
Concept of analytic function from the points of view of the CauchyRiemann equations, power series, complex integration, and conformal mapping.
Prerequisites: MATH 301
Attribute/Distribution: MA, Q

MATH 319 Introduction to Differential Equations 3 Credits
An introductory, yet rigorous treatment of topics in differential equations chosen to prepare students for advanced work in mathematics or applied mathematics. Homogeneous and non-homogeneous linear differential equations, existence and uniqueness theorems, Gronwall's inequality; systems of first order linear differential equations; autonomous first-order systems: critical points, stability, bifurcation; series and periodic solutions, Fourier series and their convergence; introduction to numerical simulation methods.
Prerequisites: MATH 242 or MATH 205 or MATH 241
Attribute/Distribution: Q

MATH 320 Ordinary Differential Equations 3-4 Credits
The analytical and geometric theory of ordinary differential equations, including such topics as linear systems, systems in the complex plane, oscillation theory, stability theory, geometric theory of nonlinear systems, finite difference methods, general dynamical systems.
Prerequisites: MATH 023 and (MATH 205 or MATH 319)
Attribute/Distribution: Q

MATH 321 Topics in Discrete Mathematics 3 Credits
Selected topics in areas of discrete mathematics. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 322 Methods of Applied Analysis I 3 Credits
Fourier series, eigenfunction expansions, SturmLiouville problems, Fourier integrals and their application to partial differential equations; special functions. Emphasis is on a wide variety of formal applications rather than logical development.
Prerequisites: MATH 205 or MATH 319
Attribute/Distribution: Q

MATH 323 Methods of Applied Analysis II 3 Credits
Green's functions; integral equations; variational methods; asymptotic expansions, method of saddle points; calculus of vector fields, exterior differential calculus.
Prerequisites: MATH 322
Attribute/Distribution: MA, Q

MATH 327 Groups and Rings 3-4 Credits
An intensive study of the concepts of group theory including the Sylow theorems, and of ring theory including unique factorization domains and polynomial rings.
Prerequisites: MATH 242 and MATH 243
Attribute/Distribution: MA, Q

MATH 331 Differential Geometry of Curves and Surfaces 3 Credits
Local and global differential geometry of curves and surfaces in Euclidean 3space. Frenet formulas for curves, isoperimetric inequality, 4vertex theorem; regular surfaces, first fundamental form, Gauss map, second fundamental form; curvatures for curves and surfaces and their relations; The GaussBonnet theorem.
Prerequisites: MATH 023 and (MATH 205 or MATH 242)
Attribute/Distribution: Q

MATH 334 Mathematical Statistics 3-4 Credits
Populations and random sampling; sampling distributions; theory of statistical estimation; criteria and methods of point and interval estimation; theory of testing statistical hypotheses.
Prerequisites: MATH 263 or MATH 309
Attribute/Distribution: Q

MATH 338 Statistical Models in Data Science 3,4 Credits
Least square principles in multiple regression and their interpretations; estimation, hypotheses testing, confidence and prediction intervals, modeling, regression diagnostic, multicollinearity, model selection, analysis of variance and covariance; logistic regression. Introduction to topics in time series analysis such as ARMA, ARCH, and GARCH models. Applications to natural sciences, finance and economics. Use of computer packages.
Prerequisites: (MATH 012 or MATH 231 or MATH 264) and (MATH 043 or MATH 205 or MATH 241 or MATH 242 or STAT 342)
Attribute/Distribution: Q

MATH 339 Time Series and Forecasting 3,4 Credits
This course introduces the student to the statistical analysis of time series data and useful models: autocorrelation, stationarity, trend removal, and seasonal adjustment, basic time series models like AR, MA, ARMA; estimation, forecasting, and GARCH models; multivariate models, and factor models. The course emphasizes the main ideas and the most popular and widely used methods, and the use of a computer to practice the methods. Knowledge of scientific programming in a language such as R required.
Prerequisites: (MATH 264 or MATH 312) and (MATH 263 or MATH 309)
Attribute/Distribution: Q

MATH 340 (CSE 340) Design and Analysis of Algorithms 0,3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, finding shortest paths and minimum spanning trees, scheduling tasks, etc.: proofs of their correctness and analysis of their asymptotic runtime and memory demands. Designing algorithms: recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency using elementary NP-completeness theory.
Prerequisites: (MATH 021 or MATH 031 or MATH 076) and CSE 140 and CSE 017
Attribute/Distribution: Q

MATH 341 Mathematical Models and Their Formulation 3 Credits
Mathematical modeling of engineering and physical systems with examples drawn from diverse disciplines. Emphasis is on building models of real world problems and the analysis as well as numerical simulations of the models.
Prerequisites: MATH 205 or MATH 241 or MATH 242
Attribute/Distribution: Q

MATH 342 Number Theory 3-4 Credits
Basic concepts and results in number theory, including such topics as primes, the Euclidean algorithm, Diophantine equations, congruences, quadratic residues, quadratic reciprocity, primitive roots, number-theoretic functions, distribution of primes, Pell’s equation, Fermat’s theorem, partitions. Consent of instructor required.
Attribute/Distribution: MA, Q

MATH 343 Introduction To Cryptography 3,4 Credits
Classical elementary cryptography: Caesar cipher, other substitution ciphers, block ciphers, general linear ciphers. Fast random encryption (DES and AES: Advanced Encryption Standard). Public key systems (RSA and discrete logs). Congruences, modular arithmetic, fast exponentiation, polynomials, matrices. Distinction between polynomial time (primality), Subexponential time (factoring) and fully Exponential computation (elliptic curves). Introduction to sieving and distributed computation. Consent of instructor required.
Attribute/Distribution: MA, Q

MATH 350 Special Topics 3 Credits
A course covering special topics not sufficiently covered in listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 365 Statistical Machine Learning 3,4 Credits
This course provides a broad introduction to concepts, methods, and practices of statistical machine learning: parametric and nonparametric regression, logistic regression, classification, and basic neural networks; kernel and nearest neighbor estimation, clustering, Bayesian and mixture models. In addition, we will explore selected topics like model selection, cross-validation; PCA, dimension reduction, regularized regression; trees, and ensemble learning. Knowledge of scientific programming in a language such as R required.
Prerequisites: (MATH 205 or MATH 241 or MATH 242) and (MATH 264 or MATH 312) and (MATH 263 or MATH 309)
Attribute/Distribution: Q

MATH 371 Readings 1-3 Credits
The study of a topic in mathematics under appropriate supervision, designed for the individual student who has studied extensively and whose interests lie in areas not covered in the listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 374 Statistical Project 3 Credits
Supervised field project or independent reading in statistics or probability. Consent of department chair required.
Attribute/Distribution: MA, Q, W

MATH 381 Undergraduate Research 1-4 Credits
Research in mathematics or statistics under the direction of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q

MATH 391 Senior Honors Thesis 3 Credits
Independent research under faculty supervision, culminating in a thesis presented for departmental honor. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

MATH 401 Real Analysis I 3 Credits
Set theory, real numbers; introduction to measures, Lebesgue measure; integration, general convergence theorems; differentiation, functions of bounded variation, absolute continuity; Lp spaces.
Prerequisites: MATH 301

MATH 402 Real Analysis II 3 Credits
Metric spaces; introduction to Banach and Hilbert space theory; Fourier series and Fejer operators; general measure and integration theory, RadonNikodym and Riesz representation and theorems; LebesgueStieljtes integral.
Prerequisites: MATH 307 or MATH 401

MATH 405 Partial Differential Equations I 3 Credits
Classification of partial differential equations; methods of characteristics for first order equations; methods for representing solutions of the potential, heat, and wave equations, and properties of the solutions of these equations; maximum principles.
Prerequisites: MATH 319 or MATH 320

MATH 406 Partial Differential Equations II 3 Credits
Continuation of MATH 405. Emphasis on second order equations with variable coefficients and systems of first order partial differential equations.
Prerequisites: MATH 405

MATH 408 Algebraic Topology I 3 Credits
Polyhedra; fundamental groups; simplicial and singular homology.

MATH 409 Mathematics Seminar 1-6 Credits
An intensive study of some field of mathematics not offered in another course. Consent of department chair required.

MATH 410 Independent study 1-4 Credits
The study of a topic in mathematics under appropriate supervision, designed for the individual student who has studied extensively and whose interests lie in areas not covered in the listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 416 Complex Function Theory 3 Credits
Continuation of MATH 316.
Prerequisites: MATH 316

MATH 423 Differential Geometry I 3 Credits
Differential manifolds, tangent vectors and differentials, submanifolds and the implicit function theorem. Lie groups and Lie algebras, homogeneous spaces. Tensor and exterior algebras, tensor fields and differential forms, de Rham cohomology, Stokes' theorem, the Hodge theorem. Must have completed the required course prerequisites or receive permission of instructor.
Prerequisites: MATH 243 and MATH 301 and MATH 307

MATH 424 Differential Geometry II 3 Credits
Curves and surfaces in Euclidean space; mean and Gaussian curvatures, covariant differentiation, parallelism, geodesics, GaussBonnet formula. Riemannian metrics, connections, sectional curvature, generalized GaussBonnet theorem. Further topics.
Prerequisites: MATH 423

MATH 428 Fields And Modules 3 Credits
Field theory, including an introduction to Galois theory; the theory of modules, including tensor products and classical algebras.
Prerequisites: MATH 327

MATH 430 Numerical Analysis 3 Credits
Multistep methods for ordinary differential equations; finite difference methods for partial differential equations; numerical approximation of functions. Use of computer required.
Prerequisites: MATH 230

MATH 435 Functional Analysis I 3 Credits
Banach spaces and linear operators; separation and extension theorems; open mapping and uniform boundedness principles; weak topologies; local convexity and duality; Banach algebras; spectral theory of operators; and compact operators.
Prerequisites: MATH 307 and MATH 401

MATH 444 Algebraic Topology II 3 Credits
Continuation of MATH 408. Cohomology theory, products, duality.
Prerequisites: MATH 408

MATH 445 Topcs in Algebraic Topology 3 Credits
Selected topics reflecting the interests of the professor and the students.
Prerequisites: MATH 444

MATH 449 Topics In Algebra 3 Credits
Intensive study of topics in algebra with emphasis on recent developments. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 450 Special Topics 3 Credits
Intensive study of some field of the mathematical sciences not covered in listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 455 Topics In Number Theory 3 Credits
Selected topics in algebraic and/or analytic number theory. Consent of instructor required.
Repeat Status: Course may be repeated.

MATH 461 Topics In Mathematical Statistcs 3 Credits
An intensive study of one or more topics such as theory of statistical tests, statistical estimation, regression, analysis of variance, nonparametric methods, stochastic approximation, and decision theory.
Repeat Status: Course may be repeated.
Prerequisites: MATH 334 and MATH 401

MATH 462 Modern Nonparametric Methods in Statistics 3 Credits
Classical and modern methods of nonparametric statistics; order and rank statistics; tests based on runs, signs, ranks, and order statistics; distribution free statistical procedures for means, variances, correlations, and trends; relative efficiency; KolmogorovSmirnov statistics; statistical applications of Brownian process; modern techniques such as robust methods, nonparametric smoothing, and bootstrapping; additional topics such as nonparametric regression and dimension reduction.
Prerequisites: (MATH 334 or STAT 334) and (MATH 338 or STAT 338)

MATH 463 (STAT 463) Advanced Probability 3 Credits
Measure theoretic foundations; random variables, integration in a measure space, expectations; convergence of random variables and probability measures; conditional expectations; characteristic functions; sums of random variables, limit theorems.
Prerequisites: MATH 309 and MATH 401

MATH 464 Advanced Stochastic Process 3 Credits
Theory of stochastic processes; stopping times; martingales; Markov processes; Brownian motion; stochastic calculus; Brownian bridge, laws of suprema; Gaussian processes.
Prerequisites: MATH 309 and MATH 401

MATH 465 Topics in Probability 3 Credits
Selected topics in probability. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 467 Stochastic Calculus 3 Credits
Brownian Motion, Martingales. Introduction to the theory of Stochastic Calculus, Itô Formula, and Stochastic Differential Equations, Black-Scholes model. Development of the Martingale Representation Theorem and Girsanov's theorem for change of measure. Multidimensional Stochastic Calculus. Applications to different problems from finance, physics, biology, etc.
Prerequisites: MATH 231 or MATH 309

MATH 468 Financial Stochastic Analysis 3 Credits
Basic mathematical concepts behind pricing of derivative securities. Hedging and pricing by arbitrage in the setting of binary trees and Black-Scholes model. Application of Stochastic Calculus to the pricing of a variety of financial instruments: multiple stock models, American and exotic options, and foreign currency interest rate. Heath-Jarrow-Morton model for the term structure of interest rates and short rate models. Applications of the theory to a variety of interest rates contracts including swaps, caps, floors, swap options.
Prerequisites: MATH 467

MATH 470 Proseminar 1-3 Credits
Preparation for entering the mathematics profession. Topic of emphasis typically include methods of teaching mathematics, commonly available research tools and the publication process, the responsibilities of an academic position, and searching for a job. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 471 Homological Algebra 3 Credits
Modules, tensor products, categories and functors, homology functors, projective and injective modules.
Prerequisites: MATH 428

MATH 472 Group Representations 3 Credits
Linear representations and character theory with emphasis on the finite and compact cases.
Prerequisites: MATH 428

MATH 475 Topics in Geometry 3 Credits
Selected topics in geometry, such as geometric analysis, algebraic geometry, complex geometry, characteristic classes, geometric flows or geometric measure theory, with emphasis on recent developments. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 490 Thesis 1-6 Credits

MATH 491 Research 1-4 Credits
Research in mathematics or statistics under the direction of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Statistics Courses

STAT 342 Applied Linear Algebra 3 Credits
The theoretical basis for applying linear algebra in other fields, including statistics. Topics will include systems of equations, vector spaces, matrices, and linear transformations. Additional topics will include matrix factorizations (including LU, QR, eigen-decomposition, and SVD) and how they can be used in computer analysis of data sets. Not available for credit to students who have completed MATH 241 or MATH 242.
Prerequisites: MATH 022 or MATH 032 or MATH 052 or MATH 082
Attribute/Distribution: Q

STAT 408 Seminar in Statistics and Probability 1-6 Credits
Intensive study of some field of statistics or probability not offered in another course. Consent of department required.

STAT 409 Seminar in Statistics and Probability 1-6 Credits
Intensive study of some field of statistics or probability not offered in another course. Consent of department required.

STAT 410 Random Processes and Applications 3 Credits
See MATH 310.

STAT 412 Advanced Applied Statistics 3 Credits
Selected advanced topics in applied statistics. Possible topics include nonparametric statistics, multivariate statistics, generalized linear model, survival analysis, time series analysis or other modern applied statistical methods with application to real world problems. Topics could vary from one semester to another depending on the interests of the faculty member and the students.
Repeat Status: Course may be repeated.

STAT 434 Mathematical Statistics 3 Credits
See MATH 334.

STAT 438 Linear Models In Statistics with Applications 3 Credits
See MATH 338.

STAT 439 Time Series and Forecasting 3 Credits
See MATH 339.

STAT 461 Topics In Mathematical Statistics 3 Credits
See MATH 461.

STAT 462 Modern Nonparametric Methods in Statistics 3 Credits
See MATH 462.

STAT 463 (MATH 463) Advanced Probability 3 Credits
See MATH 463.
Prerequisites: MATH 309 and MATH 401

STAT 464 Advanced Stochastic Processes 3 Credits
See MATH 464.

STAT 465 Statistical Machine Learning 3 Credits
See MATH 365.

STAT 471 Topics in Statistical Learning and Computing 3 Credits
Selected advanced topics in statistical learning and computing. Possible topics include linear and nonlinear regression, applied spatial statistics, applied multivariate and longitudinal data analysis, functional data analysis, survival analysis, data analytics, statistical methods that use intensive-computing or simulations, data mining techniques, with application and interpretation of a variety of statistical methods in real world problems. Topics could vary from one semester to another depending on the interests of the faculty member and the students.
Repeat Status: Course may be repeated.

STAT 474 Statistical Practice 3 Credits
Outside university consulting practice that is led by faculty members and experienced members from companies in the region. The live consulting projects provide working examples from which students gain practical experience in statistical practice. Students use this experience to assemble a portfolio of materials that demonstrates the knowledge and skills they have gained during their time in the program. This also offers opportunities to interface with working professionals through the practical training experience. Permission of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: MATH 312 and STAT 438 and STAT 434 and (STAT 465 or STAT 471)

Modern Languages and Literatures

The core mission of the Department of Modern Languages and Literatures is to prepare students to be engaged global citizens, ready to work effectively in a multicultural and multilingual world. Our department equips students with linguistic and analytical tools for solving complex issues with transcultural components. The faculty are active scholars with rising or established international profiles who model skills and are dedicated to training students in critical reading, thinking, writing, and research methodologies. We are dedicated to dialogue with cultures beyond the Anglophone world.

Language and Cultural Study Offerings

Linguistic training is available in Arabic, Mandarin Chinese, French, German, Hebrew, Japanese, Russian, and Spanish languages. Cultural studies include courses in the target language and in English (MLL) on literature, film, and a range of other forms of cultural expression.

Language requirements

Language (ARAB, CHIN, FREN, GERM, HEBR, JPNS, RUSS, SPAN) and MLL courses satisfy humanities, diversity, Global Studies, and Asian Studies requirements. Majors which require language study include GS/MLL, IR/MLL, Asian Studies, Latin American and Latino Studies, Chinese, French, German, Japanese, and Spanish.

Major Programs

The department offers major programs in Chinese, French and Francophone Studies, German, Japanese, Spanish and Hispanic Studies, and Joint IR/MLL. The candidate for the major is expected to demonstrate adequate written and oral command of the language, as well as knowledge of its literature and culture. A period of study abroad is strongly recommended.

Double majors and Arts-Engineering majors including a language component are well-received by employers. Studies in the two areas are carefully coordinated by major advisers.

Major in Chinese

The major in Chinese will require 36 credits: a minimum of 24 credits in courses taught in Chinese, including 8 credits at the 200 or 300 level of Chinese language and literature (marked CHIN). Courses offered in English in MLL on Chinese literature and history may be included in the major and a maximum of two courses outside of MLL in the Asian Studies Program that are concerned specifically with China, such as those available in International Relations, Political Science, Religion, Sociology, etc., by approval of the major adviser. Majors in Chinese are strongly encouraged to study abroad in a Chinese speaking country.

Major in German Studies

The major in German Studies requires 32 credits in German language, literature, and culture. This includes GERM 001, GERM 002, GERM 011, GERM 012, and any German courses that are 100 level and above. At least 4 of these German credits must be at the 200 level or 300 level. Students who arrive at Lehigh with prior knowledge of German will be placed into an appropriate level and take more advanced German courses. At least 24 of the required 32 credits need to be taught in German. A maximum of two courses may be taught in English when students complete writing assignments in German, and one of these courses with German Studies content may be chosen in another department, in consultation with the advisor. Majors in German Studies are strongly encouraged to participate in a study abroad program in a German speaking country for the equivalent of one semester or more. A maximum of 16 credits of study abroad may be transferred toward the major, with a maximum of 8 credits for summer, 12 credits for a semester, and 16 credits for a year of study abroad. In order to have credits from foreign institutions count toward their major, students must obtain approval from the German Studies advisor prior to their departure. Transfer students may transfer up to 12 credits from another college or university toward the major. Credits from Advanced Placement (AP) exams and SAT subject tests count toward graduation but NOT toward the major in German Studies.

Major in German Studies

German Language Coursework [1]	20
Advanced German coursework at the 200 or 300-level	4
Additional electives in GERM or MLL	8
Total Credits	32

1

These courses may include GERM 001, 002, 011, and 012. Students who arrive at Lehigh with prior knowledge of German will be placed into a higher level of language study.

Major in French and Francophone Studies

The French and Francophone Studies Major requires 32 credits of course work, including French 001, 002, 011 and 012, or any French courses at 100 level and above with a minimum of 4 credits at the 200-300 level. The following courses are required of all majors and minors: courses at the Elementary and intermediate language level, Composition and Conversation (FREN 145) combined in one course, and Introduction to Literary Analysis (FREN 152). Students who start our Program at the Intermediate level or above will placed accordingly. Majors who start at the intermediate level or above will be encouraged to keep taking FREN/MLL courses with us past the required ones to complete the 8-course requirement but will also be allowed to count one course with French-Francophone content taken in other departments. A list of approved courses will be created in consultation with other programs and departments.

A maximum of 16 credits of study abroad may be transferred toward the major, with a maximum of 8 credits for summer, 12 credits for a semester, and 16 credits for a year of study abroad. In order to have credits from foreign institutions count toward their major, students must obtain approval from the French and Francophone major advisor prior to their departure.

Transfer students may transfer up to 12 credits from another college or university toward the major. Credits from Advanced Placement (AP) exams and SAT subject tests count toward graduation but NOT toward the major in French and Francophone Studies.

French Language coursework		**28**
FREN 001	Elementary French I [1]	
FREN 002	Elementary French II [1]	
FREN 011	Intermediate French I [1]	
FREN 012	Intermediate French II [1]	
FREN 145	French Conversation and Composition	
FREN 152	Introduction to Literary Analysis	
Additional 100-level course		
Any FREN course at the 200 or 300-level		4
Total Credits		**32**

1

Students who arrive at Lehigh with prior knowledge of French will be placed into a higher level of language study.

Major in Japanese

The major in Japanese Studies requires 35 credits: a minimum of 23 credits in Japanese languages beyond JPNS 002; 3 credits from

Study Abroad in Japan, and a minimum of 9 credits (or 3 courses) in Japanese literature and culture courses offered in English in MLL (electives). For elective courses, a maximum of two courses can be taken outside of MLL, either from study-abroad or the list of Japanese-related courses offered in the Asian Studies program. If a student is financially or academically unable to fulfill the study abroad requirement, other options could be negotiated with an advisor's approval.

Requirements:

1. Japanese language courses (see recommended sequence below) = **23 credits**

2. Study Abroad (3) = **3 credits**

If a student is financially or academically unable to fulfill this requirement, other options could be negotiated with an advisor's approval**.**

3. Electives: Courses on Japan taught in English. 3 courses = **Minimum of 9 credits**

Electives can include credits from study abroad. Maximum of two courses offered outside of MLL are allowed. The following courses in the Asian Studies program cover topics related to Japan:

ASIA 010; ASIA 012; ASIA 061; ASIA 068; ASIA 119; ASIA 127; ASIA 140; ASIA 142; ASIA 162; ASIA 164; ASIA 170; ASIA192; ASIA 193; ASIA 337; ASIA 340

Total: 35 credits

Students must take the Elementary Japanese I (JPNS001) in the first semester upon arrival at Lehigh unless they have previously studied the Japanese language equivalent to JPNS 1 and 2. The following is the recommended semester-by-semester roster.

Semester 1: JPNS 001 (prerequisite)

Semester 2: JPNS 002 (Prerequisite)

Semester 3: JPNS 011, One course in MLL/Asia

Semester 4: JPNS 012, One Course in MLL/Asia

Semester 5: JPNS 131&151, One course in MLL/Asia OR Study Abroad

Semester 6: JPNS 132&152,

Semester 7: JPNS 231

Semester 8: JPNS 232, JPNS 290 (Major Paper)

Major in Spanish and Hispanic Studies

Spanish and Hispanic Major

Core Courses		**12**
SPAN 141	Advanced Spanish Grammar	4
SPAN 151	Cultural Evolution Of Spain	4
SPAN 152	Cultural Evolution of Latin America	4
Advanced course work		**12**
or three courses at the 300 level.		
Electives		**8**
at the 100 or 200 level.		
Collateral requisites		**6-8**
from a list of approved courses taken in other programs and departments. These courses must be approved by the Spanish major adviser.		

Majors in Spanish and Hispanic Studies are strongly encouraged to participate in a study program in a Spanish-speaking country for the equivalent of one semester or more. Up to 12 credits for courses taken during one semester abroad (16 credits during one year) may count toward the major. In order to have credits from foreign institutions count toward their major, students must obtain approval from the Spanish major adviser prior to their departure.

Requirements for the Departmental Honors Major (40 credits)

Requirements as for the major, plus 8 additional hours of advanced literature (honors thesis of a comprehensive type) and maintenance of a 3.20 average in the major.

Joint International Relations/Modern Languages and Literatures Major

For more information please visit the joint IR/MLL Major. (p. 188)

Minor programs

The department offers minor programs in Chinese, French, German, International Film, Japanese, Russian, and Spanish, and coordinates these studies with a student's major requirements in any college.

Requirements for the Minor in French

16 credit hours are required above French 11 as follows:

1. French 12 (4)
2. French 143 (4)
3. 1 course at the 100-200 level (4)
4. 1 course at the 200-300 level (300 level courses are open to students who have completed 8 credits of French beyond French 12) (4)

Requirements for the Minor in German

16 credit hours, taught in the German language, are required above GERM 002. This includes GERM 011, GERM 012, and any courses in German that are 100 level and above.

A maximum of 8 credits, from study abroad or another college or university, may be transferred toward the minor in German. Credits from Advanced Placement (AP) exams and SAT subject tests count toward graduation but NOT toward the minor in German.

Requirements for the Minor in Spanish

The minor in Spanish and Hispanic Studies requires 16 credits above Spanish 012. Students may choose between two tracks, as described below:

Hispanic Cultures Track: SPAN 141, 151 or 152, a 300-level course, and a course at the 200-level or above.

Professional Track: SPAN 141, 151 or 152, 211 or 270, and a course at the 200-level or above.

Requirements for the Minor in Chinese

16 credit hours of CHIN courses at any level
A maximum of 8 credits hours can be transferred
Note that beginning learners with no background should take both "Spoken" and "Reading & Writing" courses for a total of 4 credits each semester (CHIN 1 & 3 in Fall, 2 & 4 in Spring the first year and CHIN 11 & 13 in Fall, 12 & 14 in Spring the second year). Those with experience in one or the other can discuss alternative options with the instructors.

Requirements for the Minor in Japanese

16 credit hours of JPNS courses at any level
A maximum of 8 credits hours can be transferred

Requirements for the Minor in Russian

16 credit hours of RUSS courses at any level
A maximum of 8 credits hours can be transferred

Language of instruction

All courses marked ARAB, CHIN, FREN, GERM, JPNS, RUSS, and SPAN are taught in the target language. ALL courses marked MLL are taught in English.

Language placement

Students are normally placed in language courses on the basis of years of a language taken in high school, CEEB Achievement Test score, or the departmental equivalent (instructor's test, interview, or questionnaire). Students may change levels within a language during the first two weeks of class. Students who consider themselves capable of higher-level performance may apply to the instructor during the first two weeks of the semester for more advanced placement. They may also be allowed by the department chair to be admitted for credit to a *lower-level language course after consultation with the instructor. Students who have had three years or more of a language in high school and drop to first-semester level will not receive credit for*

the course. No course under 100 level may be taken for credit once a higher course has been passed.

Courses in English

The department offers elective courses in English on literary, cultural, and social subjects listed under the rubric MLL. Most of these courses are cross listed with associated departments and interdisciplinary programs and count in their major and minor programs. These and many language courses count in many colleges as global and diversity requirements

The department offers elective courses in English on literary, cultural, and social subjects listed under “International Culture and Literature Taught in English."

These courses may, in most cases, be taken to fulfill preliminary distribution requirements. One of these courses may be included in the major.

Study Abroad and Travel Grants

The department encourages all students, especially majors and minors, to spend a summer, a semester, or a full year on an approved program of study abroad. Many programs with language study can be found at Study Abroad (https://global.lehigh.edu/study-abroad).

For grants and travel support, see https://cas.lehigh.edu/content/undergraduate grants.

Transfer credit must be arranged ahead of time. For the transfer of language and culture study credits for languages not offered at Lehigh, for example, Hindi, Italian, or Korean, credit in MLL 099, 199, 299, or 399 is available depending on the level.

Summer or semester study abroad at approved programs may be incorporated into language majors and minors with the permission of the appropriate advisor to a maximum of 16 credits toward the major and 8 credits toward the minor.

INTERNATIONAL CULTURES AND LITERATURES TAUGHT IN ENGLISH

These courses on international cultures and comparative topics carry no prerequisites; knowledge of the language is not required.

Language majors may count one MLL course taught in English for credit toward a major requirement. Interested students should consult their language major advisors. For course descriptions, see under each language area below.

HEBREW

The department offers courses both separately and in the context of the Jewish studies minor (p. 185).

Modern Hebrew is taught in the Department of Modern Languages and Literature. Biblical Hebrew is taught in the Department of Religion Studies.

Arabic Courses

ARAB 001 Elementary Arabic I 4 Credits
The general objective of this course is to familiarize students with the sounds and the letters of Arabic, along with basic communication skills. Students are required to use Arabic in class discussion. Attendance and class participation are necessary to achieve the above-stated goals. Upon completion of this course, students will be able to read, write, speak, and understand Arabic at the elementary level.
Attribute/Distribution: AL, HU

ARAB 002 Elementary Arabic II 4 Credits
Continuation of ARAB 001. Emphasis on communicative ability in oral and writing skills and use of the language. Students develop ability to communicate with native speakers on a variety of everyday topics; introductions, descriptions of people and things, disseminating information, stating preferences, describing locations, etc. Students will be able to read, write, speak, and understand authentic materials on familiar topics, as well as recognize and understand various grammatical rules and their application in context, and expand their cultural awareness.
Attribute/Distribution: AL, HU

ARAB 011 Intermediate Arabic I 4 Credits
Development of communication skills and cultural awareness through reading materials and viewing films. Grammar is presented in context. Emphasis on communicative ability in oral and writing skills, and on the use and cultural aspects of the language through authentic materials. Students learn how to communicate effectively and appropriately while satisfying their intellectual curiosity to learn about the civilization and culture, current as well as historical dimensions.
Prerequisites: ARAB 002
Attribute/Distribution: AL, HU

ARAB 012 Intermediate Arabic II 4 Credits
Enhancement of communication skills, proficiency, competence, and use of the language. Students will enhance and develop their ability to understand the spoken word and to converse on a variety of topics; discuss, narrate, and read authentic materials that cover a variety of issues and topics; e.g., educational, cultural, and factual; write short paragraphs; recognize and use grammatical rules in context; and expand cultural awareness through class discussion and reading materials. Frequently taught in the target language to emphasize and reinforce classroom use. Students will be able to read, write, speak, and understand Arabic at the upper intermediate level.
Attribute/Distribution: HU

ARAB 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

ARAB 099 (ASIA 099, CHIN 099, FREN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 1-8 Credits
Beginning level of Arabic languages, literatures, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

ARAB 180 Independent Study 1-4 Credits
Topics related to Arabic language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

ARAB 199 (ASIA 199, CHIN 199, FREN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Arabic language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

ARAB 231 Third Year Arabic I 4 Credits
Enhance fluency, particularly conversational Arabic. Emphasis on comprehension of written and spoken language. Dialogue, reading, and analysis of texts to enhance critical thinking, as well as promote mastery of the language. Immersion in overall increase in fluency. Advanced level geared towards command and comprehension of conversation and written texts, textbooks, and media (i.e., newspaper, magazine).
Attribute/Distribution: HU, W

ARAB 232 Third Year Arabic II 4 Credits
Continuation of Third Year Arabic I. Emphasis on comprehension of written and spoken language. Dialogue, reading, and analysis of texts to enhance critical thinking, as well as promote mastery of the language. Immersion in overall increase in fluency. Advanced level geared towards command and comprehension of conversation and written texts, textbooks, and media (i.e., newspaper, magazine).
Attribute/Distribution: HU, W

ARAB 280 Independent Study 1-4 Credits
Topics related to Arabic language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 299 (ASIA 299, CHIN 299, FREN 299, GERM 299, HEBR 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of Arabic language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ARAB 341 Fourth Year Arabic I 4 Credits
Enhance fluency, particularly conversational and written Arabic. Reading and analysis of texts to enhance critical thinking, and promote mastery of the language. Immersion and overall increase in fluency. Students will be expected to communicate with classmates and the instructor in Arabic and to make presentations in Arabic pertaining to current events. Increased use of Arabic during classroom instruction. Students expected to come prepared to present something that utilizes the language: poems, personal stories or experiences, current event articles etc.
Attribute/Distribution: HU, W

ARAB 342 Fourth Year Arabic II 4 Credits
Continuation of Fourth Year Arabic I. Enhance fluency, particularly conversational and written Arabic. Emphasis on reading and analysis of texts to enhance critical thinking, promote mastery of the language. Immersion and overall increase in fluency. Students will be expected to communicate with classmates and the instructor in Arabic and to make presentations in Arabic pertaining to current events. Increased use of Arabic during classroom instruction. Students expected to come prepared to present something that utilizes the language: poems, personal stories.
Attribute/Distribution: HU, W

ARAB 380 Independent Study 1-4 Credits
Topics related to Arabic language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

ARAB 399 (CHIN 399, FREN 399, GERM 399, HEBR 399, JPNS 399, MLL 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of Arabic language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Chinese Courses

CHIN 001 Beginning Chinese Reading and Writing I 2 Credits
Introduction to the Chinese writing system and beginning character acquisition; reading practice with pinyin transcription system. (Fall) Non-heritage speakers are strongly encouraged to take the Spoken of the same level during the same semester as this Reading and Writing course.
Attribute/Distribution: AL, HU

CHIN 002 Beginning Chinese Reading and Writing II 2 Credits
Continuation of CHIN 001: continued character acquisition, reading practice in pinyin and simple character texts. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.
Attribute/Distribution: AL, HU

CHIN 003 Beginning Spoken Chinese I 2 Credits
Introduction to Mandarin Chinese pronunciation, the pinyin transcription system, and modern colloquial Chinese; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.
Attribute/Distribution: AL, HU

CHIN 004 Beginning Spoken Chinese II 2 Credits
Continuation of CHIN 003: further practice with text based dialogues in modern colloquial Chinese; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.
Attribute/Distribution: AL, HU

CHIN 011 Intermediate Chinese Reading and Writing I 2 Credits
Continued focus on vocabulary/character acquisition and text-based reading and writing exercises using Chinese characters. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.
Attribute/Distribution: AL, HU

CHIN 012 Intermediate Chinese Reading and Writing II 2 Credits
Continuation of CHIN 011: vocabulary/character acquisition and text-based reading and writing exercises using Chinese characters. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.
Attribute/Distribution: AL, HU

CHIN 013 Intermediate Spoken Chinese I 2 Credits
Further development of communicative skills in Chinese using situational dialogues and class discussion; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.
Attribute/Distribution: AL, HU

CHIN 014 Intermed Spoken Chinese II 2 Credits
Continuation of CHIN 013: further development of communicative skills in Chinese using situational dialogues and class discussion; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.
Attribute/Distribution: AL, HU

CHIN 021 Survival Chinese 2 Credits
A brief introduction to the language and culture. Focus on speaking and listening skills. Lessons based on practical situations for living or traveling in China.
Attribute/Distribution: AL, HU

CHIN 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

CHIN 099 (ARAB 099, ASIA 099, FREN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of Chinese language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

CHIN 115 Advanced Intermediate Chinese Skills I 4 Credits
Continuation of IC series to volume 3. Prerequisite: CHIN 012 or 014 or permission of the instructor. Students will gain listening, speaking, reading, and writing skills in Mandarin Chinese, attaining approximately the Intermediate-Mid to Intermediate-Adv level on the ACTFL/ETS proficiency scale.
Prerequisites: CHIN 012 or CHIN 014
Attribute/Distribution: AL, W

CHIN 116 Advanced Intermediate Chinese Skills II 4 Credits
Continuation of CHIN 115. Prerequisite: CHIN 115 or permission of the instructor. Students will gain listening, speaking, reading, and writing skills in standard (Mandarin) Chinese, attaining approximately the Intermediate-Mid to Intermediate-Adv level on the ACTFL/ETS proficiency scale.
Prerequisites: CHIN 115
Attribute/Distribution: AL, W

CHIN 119 Writing Skills in Chinese 2 Credits
Students above the intermediate level of spoken and written Chinese work individually with the instructor on topics of their own choice.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU, W

CHIN 122 Intermediate Business Chinese 2 Credits
Introduction to Chinese business environment and business terminology. Emphasis on reading comprehension and translation.
Attribute/Distribution: AL, HU

CHIN 124 Chinese Translation Workshop 4 Credits
The objectives of this course are to improve students' facility in working between Chinese and English by improving their ability to translate from one into the other. Students will render Chinese text into English , or vice versa, in a workshop environment that fosters cooperation and mutual enrichment. The language of instruction is Chinese. The 100 level workshop is for those who have previously taken Chinese at the 100-level or equivalent. Course may be repeated for credit.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU, W

CHIN 134 Chinese Short Stories 2 Credits
Supplementary reading designed for students at the intermediate level Chinese. Focus on improved reading and speaking proficiency. Reading materials will strengthen understanding of both contemporary and historical Chinese culture.
Attribute/Distribution: AL, HU, W

CHIN 180 Independent Study 1-4 Credits
Topics related to China or Chinese language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

CHIN 199 (ARAB 199, ASIA 199, FREN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Chinese language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

CHIN 224 Chinese Translation Workshop 4 Credits
The objectives of this course are to improve students' facility in working between English and Chinese by improving their ability to translate from one into the other. Students will render Chinese text into English or vice versa, in a workshop environment that fosters cooperation and mutual enrichment. The language of instruction is Chinese. This 200-level workshop is for students who have completed the 100-level workshop. Course may be repeated for credit.
Repeat Status: Course may be repeated.
Prerequisites: CHIN 124
Attribute/Distribution: HU, W

CHIN 230 Chinese Translation Workshop 4 Credits
The objectives of this course are to improve students' facility in working between Chinese and English by improving their ability to read and understand in the former while translating into the latter. Students will render Chinese text into English on a weekly basis in a workshop environment that fosters cooperation and mutual enrichment. The language of instruction is Chinese.
Attribute/Distribution: HU, W

CHIN 237 Chinese Film Art 4 Credits
This course is an introduction to Chinese film art, from its narrative forms to elements of style. Students will analyze individual films in both presentations and compositions. The course objectives encompass a keener appreciation of Chinese cinema as well as an enhanced ability to comprehend, speak, read, and write Chinese. The language of instruction is Chinese. This 200-level course is for those who have previously taken Chinese at the 100-level or equivalent.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CHIN 252 Advanced Business Chinese 2 Credits
Directed readings on the Chinese business environment and business terminology. Emphasis on reading comprehension and translation.
Attribute/Distribution: HU, W

CHIN 255 Newspaper Readings In Chinese 2 Credits
Newspaper readings in Chinese. Emphasis on reading comprehension and translation.
Prerequisites: CHIN 112 or CHIN 114
Attribute/Distribution: HU

CHIN 280 Independent Study 1-4 Credits
Topics related to China or Chinese language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 299 (ARAB 299, ASIA 299, FREN 299, GERM 299, HEBR 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of Chinese language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

CHIN 337 Chinese Film Art 4 Credits
This course is an introduction to Chinese film art, from its narrative forms to elements of style. Students will analyze individual films in both presentations and compositions. The course objectives encompass a keener appreciation of Chinese cinema as well as an enhanced ability to comprehend, speak, read, and write Chinese. The language of instruction is Chinese. This 300-level course is for those who have previously taken Chinese at the 200-level or equivalent.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CHIN 371 Advanced Readings in Chinese 1-4 Credits
Directed study of an author, genre, or period not covered in regular courses. Can be combined with select Asian Studies courses to include relevant readings in English. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 380 Independent Study 1-4 Credits
Topics related to China and Chinese language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

CHIN 399 (ARAB 399, FREN 399, GERM 399, HEBR 399, JPNS 399, MLL 399, RUSS 399, SPAN 399) 0-8 Credits
Professional level of Chinese language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

French Courses

FREN 001 Elementary French I 4 Credits
Multimedia approach to the study of French. Introduction to French conversation, grammar, and culture.
Attribute/Distribution: AL, HU

FREN 002 Elementary French II 4 Credits
Continuation of FREN 001.
Attribute/Distribution: AL, HU

FREN 011 Intermediate French I 4 Credits
Further acquisition of the fundamentals of French conversation, writing, and culture. Multimedia approach.
Attribute/Distribution: AL, HU

FREN 012 Intermediate French II 0,4 Credits
Continuation of FREN 011.
Attribute/Distribution: AL, HU

FREN 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

FREN 099 (ARAB 099, ASIA 099, CHIN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of French language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

FREN 145 French Conversation and Composition 4 Credits
Intensive practice in oral and written French and introduction to literary criticism. Emphasis on comprehension and oral performance of the French language. Student acquires confidence in speaking and writing French through discussions and written applications of current issues, articles, novels, movies, and other topics. Required for French majors.
Attribute/Distribution: HU, W

FREN 152 Introduction to Literary Analysis 4 Credits
Exposure to representative French and Francophone works from the Middle Ages to the Twenty-First Century offering various critical strategies needed to read and interpret a literary text.
Attribute/Distribution: AL, HU, W

FREN 180 Independent Study 1-4 Credits
Topics related to French and Francophone Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

FREN 199 (ARAB 199, ASIA 199, CHIN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of French language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

FREN 235 French Short Stories in Context 4 Credits
Reading and discussion of a selection of mostly contemporary short stories from the French-speaking world. In addition to sharpening your critical reading skills, you will be exposed to a host of issues that will be, whenever possible, contextualized through a range of recent news clips pertaining to similar topics.
Attribute/Distribution: HU

FREN 237 Introduction to the Francophone World 4 Credits
Introduction to the Francophone world through a series of texts, films, articles, etc. from Francophone Europe, North Africa, sub-Saharan Africa, Canada, Vietnam, and the Caribbean. Students will become acquainted with Francophone cultures and literatures while developing their interpretative and writing skills. In French.
Attribute/Distribution: W

FREN 242 The Harem in French and Francophone Literature and Film 4 Credits
Explore representations of this forbidden and secret feminine space, the harem, starting with French theater from the 17th century all the way to 20th-21st century Francophone North African novels and film. We will attempt a comparative study between the French and Francophone traditions and will be looking at the harem as a visual as well as textual feminine space from which narratives emerge and the extent to which they constitute a counter-discourse that questions dominant power structures.
Attribute/Distribution: HU

FREN 251 Postcolonizing France: North African Immigration 4 Credits
Depictions of North African immigrants (legal or illegal) and French citizens of North African descent in postcolonial France in novels, film, and Rap music. Explore key concepts such as hospitality, minority ethnic settlement, multiculturalism, nationality and citizenship, racism, extreme-right politics, and anti-discrimination policy, and attempt to see how North African postcolonial identities are articulated in relation to perceptions of French national identity, republican values, universalism, etc.
Attribute/Distribution: HU

FREN 255 Introduction to the Francophone World 4 Credits
Introduction to the Francophone world through a series of texts, films, articles, etc. from Francophone Europe, North Africa, Sub-Saharan Africa, Canada, Vietnam, and the Caribbean. Students will become acquainted with Francophone cultures and literatures while developing their interpretative and writing skills. In French.

FREN 259 (GS 259) Contemporary France 3-4 Credits
How is France defining itself today as a European nation in a global world? Issues to be explored include: family, gender, race and religion, the education and social systems, immigration, and politics. Strongly recommended for students who plan to study abroad in France.
Attribute/Distribution: HU, W

FREN 271 French Readings 4 Credits
Study of the works of some author or group of authors, or of a period, or of a literary theme.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

FREN 280 Independent Study 1-4 Credits
Topics related to French and Francophone Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 299 (ARAB 299, ASIA 299, CHIN 299, GERM 299, HEBR 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of French language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 300 Apprentice Teaching 1-4 Credits

FREN 311 French Classicism 4 Credits
French classical theater, novel, and criticism, with emphasis on Corneille, Racine, Moliere, Pascal, Lafayette, Malherbe, and Boileau.
Attribute/Distribution: HU

FREN 312 (AAS 312, MLL 312) Modernity in the Maghreb 4 Credits
Emergence of the modern self through a comparative study of textual as well as visual representations of postcolonial subjects by male and female writers and film makers. Study of the way the sociopolitical context of countries such as Morocco, Algeria, and Tunisia informs the constitution of subjectivity within a multicultural and multilingual community. Issues such as patriarchy, nationalism, colonialism, postcolonialism, identity, gender, and Islam in North African literature and film from Franco-Arab traditions.
Attribute/Distribution: HU, W

FREN 313 The Age Of Enlightenment 4 Credits
The Philosophes and Encyclopédistes of the eighteenth century, with emphasis on Voltaire, Rousseau, Montesquieu, and Diderot.
Attribute/Distribution: HU

FREN 316 Nineteenth Century French Literature 4 Credits
Study of major nineteenth century novelists and poets.
Attribute/Distribution: HU

FREN 318 French Drama in the Twentieth Century 3 Credits
Contemporary French drama with an analysis of its origins and movements.
Attribute/Distribution: HU

FREN 320 Contemporary French Fiction 4 Credits
Reading and discussion of contemporary works of fiction (post1980). Study of how these works fit into the context of French literature and relate more specifically to major literary currents of the twentieth century.
Attribute/Distribution: HU

FREN 321 Twentieth-Century French Short Fiction 4 Credits
Examination, within the framework of short fiction, of the major literary currents that have made up twentieth-century literature. Works by Sartre, Camus, Robbe-Grillet, Le Clézio, Echenoz, Sallenave, Toussaint, Diebar, Ben Jelloun, and others.
Attribute/Distribution: HU

FREN 322 (FILM 322) Contemporary French Films 4 Credits
French Films from the late 1950s to the present. Introduction to cinematograhic language and exploration of the issues of gender, power, and madness. Films by Truffaut, J-L Godard, C. Denis, A. Varda, J-J Beineix, E. Rohmer, and others.
Attribute/Distribution: HU, W

FREN 323 (FILM 323) The Algerian War in Francophone Literature and Film 4 Credits
This course deals with representations of the Algerian War and its consequences in francophone works by postcolonial authors and filmmakers from France and Algeria. We will examine the historical context of the conflict, issues of torture, repressed memories and trauma, nation-building narratives, the meaning of independence, the role of women and the complexities of postcolonial identity formation as experienced by Algerians and the Algerian Diaspora in France. Taught in French.
Attribute/Distribution: HU, W

FREN 324 The Outsider In French Fiction 4 Credits
Focus on otherness/difference in French fiction from the eighteenth to the twentieth century. Reading and discussion of short stories and novels by Graffigny, Diderot, Maupassant, Gide, Camus, Duras, Beauvoir, Le Clézio and others.
Attribute/Distribution: HU

FREN 325 (FILM 325) Illegal immigration in Francophone Literature and Film 4 Credits
This course examines representations of illegal immigrants in postcolonial francophone literature and film. We will be looking at visual and textual narratives from and about those who decided to leave their African homeland to seek a better future in Europe despite the very restrictive policies adopted by most of the European Union on illegal immigration. The course will explore issues of postcolonial identity, the notions of borders, displacement, exile, trauma and how they relate to the act of writing.
Attribute/Distribution: HU, W

FREN 327 (WGSS 327) Women Writing In French 4 Credits
Reading and discussion of works written by women in French. The emphasis is on 19thand 20thcentury writers, such as G. Sand, Colette S. de Beauvoir, M. Duras, and Andrée Chédid.
Attribute/Distribution: HU

FREN 369 French Readings 4 Credits
Advanced study of an author, period, or theme. Topics vary. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

FREN 370 French Internship 1-8 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in French-speaking countries. Assigned readings, written reports, and employer performance evaluations are required. Consent of instructor required.
Attribute/Distribution: CC, HU, W

FREN 371 French Independent Study 1-8 Credits
Special topics under faculty guidance, including honors thesis. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 380 Independent Study 1-4 Credits
Topics related to French and Francophone Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 389 Honors Project 1-6 Credits

FREN 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

FREN 399 (ARAB 399, CHIN 399, GERM 399, HEBR 399, JPNS 399, MLL 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of French language, literature, or other culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

German Courses

GERM 001 Elementary German I 4 Credits
Fundamentals of German; reading and simple texts; simple conversation and composition; vocabulary building.Three class hours plus one laboratory or drill hour each week. No previous German required.
Attribute/Distribution: AL, HU

GERM 002 Elementary German II 4 Credits
Continuation of GERM 1, including reading of more advanced texts. Three class hours plus one laboratory or drill hour each week.
Attribute/Distribution: AL, HU

GERM 011 Intermediate German I 4 Credits
Review of grammar, composition, reading of intermediate texts, vocabulary building.
Attribute/Distribution: AL, HU

GERM 012 Intermediate German II 4 Credits
Continuation of GERM 011.
Attribute/Distribution: AL, HU

GERM 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Attribute/Distribution: AL, CC, HE, HU, W

GERM 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, HEBR 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of German language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

GERM 163 German Civilization and Culture 4 Credits
Cultural, historical, and political evolution of Germany and German-speaking countries in Europe.
Attribute/Distribution: AL, CC, HU, W

GERM 165 German Through Graphic Novels 4 Credits
This course introduces students to the wide world of German-language graphic novels. In their ever-growing popularity, graphic novels have become a dynamic medium to explore both ordinary and serious topics, such as love, memory, culture, history, trauma, identity, gender, and sexuality. At the same time, graphic novels offer the advanced language-learner an accessible and expressive means to engage with German literature through both text and image. A component of this course will be to review and build on German-language skills.
Attribute/Distribution: AL, HU, W

GERM 167 German Conversation and Composition 4 Credits
Intensive practice in spoken and written German.
Attribute/Distribution: AL, HU, W

GERM 169 Business German 4 Credits
German in business, the professions, international, and social relations. Letter writing, comprehension of technical texts, specialized vocabulary, and grammar review.
Attribute/Distribution: AL, CC, HU, W

GERM 180 Independent Study 1-4 Credits
Topics related to German Language or German Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

GERM 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, HEBR 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of German language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

GERM 231 (FILM 231, MLL 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films.
Attribute/Distribution: CC, HE, HU, W

GERM 240 Contemporary Germany 4 Credits
Readings and conversations in German about topics including the social and natural sciences, technology, the environment, politics, daily life, and sports. Practice in spoken and written German.
Attribute/Distribution: CC, HU, W

GERM 267 Advanced German Conversation and Composition 4 Credits
A continuation of Germ 167. Practice of speaking and writing skills in German through readings of more complex texts.
Attribute/Distribution: CC, HU, W

GERM 280 Independent Study 1-4 Credits
Topics related to German Language or German Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 299 (ARAB 299, ASIA 299, CHIN 299, FREN 299, HEBR 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of German language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 300 Apprentice Teaching 1-4 Credits

GERM 303 (ENGL 303, FILM 303, MLL 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: CC, HE, HU, W

GERM 305 Modern German Literature 4 Credits
Topics in German literature of the twentieth and twenty-first century.
Attribute/Distribution: HU, W

GERM 320 Berlin: Transformations of a Metropolis 4 Credits
A literary and cultural history of Berlin from its foundation to the present. After a historical overview, we will focus on the modern period that covers the Weimar Republic, the Third Reich, the divided city of the postwar era, the fall of the wall, and the continuing process of redefining Berlin's identity as Germany's old and new capital.
Attribute/Distribution: HU, W

GERM 370 German Internships 1-8 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in German-speaking countries. Assigned readings, written reports, and employer performance evaluations are required. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 380 Independent Study 1-4 Credits
Topics related to German Language or German Studies not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

GERM 399 (ARAB 399, CHIN 399, FREN 399, HEBR 399, JPNS 399, MLL 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of German language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Hebrew Courses

HEBR 001 Elementary Modern Hebrew I 4 Credits
Class instruction will focus on the introduction of the Hebrew alphabet and basic vocabulary. Instruction will also emphasize the basics of Hebrew listening comprehension, vocabulary, reading, writing, grammar and speaking. Class activities are planned for an inclusive approach to different styles of learning. No previous study of Hebrew required.
Attribute/Distribution: AL, HU

HEBR 002 Elementary Modern Hebrew II 4 Credits
Continuation of Hebrew 1. Instruction will focus on expanding Hebrew vocabulary and grammar; introduction of the past tense. Class activities are planned for an inclusive approach to different styles of learning. Hebrew 1 or previous background in Hebrew required.
Attribute/Distribution: AL, HU

HEBR 011 Intermediate Modern Hebrew I 4 Credits
Class instruction will focus on developing fundamental patterns of conversation and expanding grammar. Hebrew 1 and Hebrew 2, or previous background in Hebrew required.
Attribute/Distribution: AL, HU

HEBR 012 Intermediate Modern Hebrew II 4 Credits
Continuation of Hebrew 011. Class instruction will focus on developing fundamental patterns of conversation and expanding grammar. Hebrew 1 and Hebrew 2, or previous background in Hebrew required.
Attribute/Distribution: AL, HU

HEBR 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

HEBR 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, GERM 099, JPNS 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of Hebrew language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

HEBR 180 Independent Study 1-4 Credits
Topics related to Hebrew Language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

HEBR 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

HEBR 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, GERM 199, JPNS 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Hebrew language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

HEBR 280 Independent Study 1-4 Credits
Topics related to Hebrew Language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

HEBR 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

HEBR 299 (ARAB 299, ASIA 299, CHIN 299, FREN 299, GERM 299, MLL 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of Hebrew language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

HEBR 380 Independent Study 1-4 Credits
Topics related to Hebrew Language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

HEBR 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

HEBR 399 (ARAB 399, CHIN 399, FREN 399, GERM 399, JPNS 399, MLL 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of Hebrew language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Japanese Courses

JPNS 001 Elementary Japanese I 0,4 Credits
This course introduces the basic grammatical structures commonly found in daily situations in Japan. All four aspects of language skills are introduced. Hirangana, Katakana, and approximately 50 Kanji are introduced.
Attribute/Distribution: AL, HU

JPNS 002 Elementary Japanese II 0,4 Credits
Continuation of JPNS 001. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 001
Attribute/Distribution: AL, HU

JPNS 011 Intermediate Japanese I 0,4 Credits
Continuation of JPNS 002. This course introduces more complex grammatical structures and develops all four aspects of language skills. Slightly more emphasis on reading and writing. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 002
Attribute/Distribution: AL, HU

JPNS 012 Intermediate Japanese II 0,4 Credits
Continuation of JPNS 011.
Prerequisites: JPNS 011
Attribute/Distribution: AL, HU

JPNS 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, W

JPNS 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, GERM 099, HEBR 099, MLL 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of Japanese language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

JPNS 131 Advanced Japanese Reading and Writing I 3 Credits
Reading, translation, and writing practice using authentic Japanese materials.
Prerequisites: JPNS 012
Attribute/Distribution: AL, HU, W

JPNS 132 Advanced Japanese Reading and Writing II 3 Credits
Continuation of Advanced Japanese Reading and Writing I.
Prerequisites: JPNS 141 or JPNS 131
Attribute/Distribution: AL, HU, W

JPNS 141 Advanced Japanese I 4 Credits
This course emphasizes advanced reading comprehension on topics related to Japan. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 012
Attribute/Distribution: AL, HU, W

JPNS 142 Advanced Japanese II 4 Credits
Continuation of JPNS 141.
Prerequisites: JPNS 141
Attribute/Distribution: AL, HU, W

JPNS 151 Advanced Spoken Japanese 1 Credit
Emphasis on comprehension and oral performance of the Japanese language through discussion of current issues and other topics.
Repeat Status: Course may be repeated.
Prerequisites: JPNS 012
Attribute/Distribution: AL, HU

JPNS 180 Independent Study 1-4 Credits
Topics related to Japan and Japanese language not covered in regular courses. (1-4 credits, may be repeated) Instructor's permission.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

JPNS 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, W

JPNS 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, GERM 199, HEBR 199, MLL 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Japanese language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

JPNS 231 Advanced Japanese Reading and Writing III 3 Credits
Reading, translation, and writing practice using authentic Japanese materials.
Prerequisites: JPNS 142 or JPNS 132
Attribute/Distribution: HU, W

JPNS 232 Advanced Japanese Reading and Writing IV 3 Credits
Continuation of Advanced Japanese Reading and Writing III.
Prerequisites: JPNS 142 or JPNS 231
Attribute/Distribution: HU, W

JPNS 280 Independent Study 1-4 Credits
Topics related to Japan and Japanese language not covered in regular courses. (1-4 credits, may be repeated) Instructor's permission.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

JPNS 289 Senior Project 1-4 Credits
For students not intending to engage in a honors project.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

JPNS 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

JPNS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

JPNS 380 Independent Study 1-4 Credits
Topics related to Japan and Japanese language not covered in regular courses. (1-4 credits, may be repeated) Instructor's permission.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

JPNS 389 Honors Project 1-4 Credits
An opportunity for Japanese majors who want to undertake a project with the potential for program honors. Course may be repeated.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

JPNS 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

JPNS 399 (ARAB 399, CHIN 399, FREN 399, GERM 399, HEBR 399, MLL 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of Japanese language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Modern Languages Literatures Courses

MLL 027 Russian Classics 4 Credits
Russian classics in translation.
Attribute/Distribution: CC, HE, HU, W

MLL 050 (ASIA 050, WGSS 050) Dreaming in Pre-modern China 4 Credits
Life is a cosmic allegory experienced by a group of all-too-human incarnated spirits of the 18th century novel Story of the Stone (aka Dream of the Red Chamber). A unique depiction on the inner emotional landscape of young women and the quest for identity by Precious Jade--is he a real boy? Read and discuss in English. Option to combine with CHIN 371 for those who wish to also read and research it in Chinese.
Attribute/Distribution: HE, HU, W

MLL 070 (GS 070) Other Voices: Being Human around the Globe 4 Credits
How do the processes of globalization affect human society and our concepts of culture and identity? What do societies gain and lose from their interactions with the rest of the world? What does it mean to be human in a globalized yet diverse world? This course grapples with such questions from the humanist's point of view. Course materials include a broad selection of film, fiction, art, music, and theory, including both well-known pieces and newer works from under-represented global communities.
Attribute/Distribution: CC, HE, HU

MLL 072 (ASIA 072) Ghosts, Monsters, and J-Horror 4 Credits
What's behind our fascination with the ghost stories? What are some of the social issues that the horror stories examine? What makes us afraid? Examining Japan's long tradition of horror stories of ghosts and monsters, this course introduces students to various Japanese horror stories, ranging from the classical texts to "J-Horror," and explores how contemporary forms of popular culture such as anime, manga, and films draw on, or depart from, the traditional images of supernatural beings. No prerequisites. In English.
Attribute/Distribution: HE, HU, W

MLL 074 (ASIA 074) Chinese Cultural Program 1-8 Credits
A summer program in China, taught in English.
Attribute/Distribution: HE, HU

MLL 075 (ASIA 075, HIST 075) Chinese Civilization 4 Credits
This course reviews the evolution of Chinese culture from the Neolithic up to the end of the imperial age in 1911. While the framework is historical, students are exposed to all facets of what defines civilization, including social traditions, philosophy, religion, material culture, literature, art and architecture, military science, education, law, and institutional history. Students are encouraged to continue their study of China afterwards with the course on Modern Chinese Civilization.
Attribute/Distribution: CC, HE, HU, SS, W

MLL 078 (ASIA 078) Asian-American Studies 4 Credits
A survey of issues concerning Asians living in the United States from the perspectives of history, language, literature, and film.
Attribute/Distribution: CC, HE, HU

MLL 091 Special Topics 1-4 Credits
Materials not covered by regularly taught courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

MLL 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, GERM 099, HEBR 099, JPNS 099, RUSS 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of languages, literatures, or culture courses not regularly taught at Lehigh University.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

MLL 100 (FILM 100) Introduction to International Film 4 Credits
An introduction to international film traditions and theory. We look at the importance of cinema as both art and entertainment and consider the social, political, and economic role of film in national and global contexts.
Attribute/Distribution: HE, HU

MLL 110 (ASIA 110, REL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined.
Attribute/Distribution: HE, HU, W

MLL 115 (ASIA 115, WGSS 115) Sex, War, Women, Art 4 Credits
Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary women artists, and writings on sex workers, impacted by the Japanese empire. Students will be exposed to feminist theories in this course; taking WGSS001 is recommended prior.
Attribute/Distribution: CC, HE, HU, W

MLL 129 (GS 129) The Global Workplace: Preparing to Work around the World 4 Credits
This course uses modern literature and film to explore current theories of global and intercultural competence as well as practical approaches to the acquisition and development of skills needed to function effectively across cultural boundaries. We'll investigate changing definitions of work over time and across cultures and actively engage with contemporary global issues and the complexities of diverse cultural traditions.
Attribute/Distribution: CC, HE, HU, W

MLL 130 (ASIA 130, REL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment odyssey, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HE, HU, W

MLL 135 (ASIA 135, WGSS 135) POWER, (WO)MEN, SILENCE 4 Credits
What do women say in their writings when their voices are silenced? How does silence speak to you? How do gender, sexuality, class, and power articulate one another? Through the study of selected short stories, novels, films, and anime, this course examines various voices, cultures, histories, and societies in Japan. No prior knowledge of Japanese language is required. An introductory course taught in English.
Attribute/Distribution: HE, HU, W

MLL 140 (ANTH 140, COGS 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail.
Attribute/Distribution: SS, SW

MLL 152 (ASIA 152, GS 152) Chinese Literature in the World 4 Credits
What place does Chinese literature occupy in the world? In this course we will read and discuss important works of modern Chinese fiction and drama alongside critical and theoretical writings on world literature. Student papers will integrate these discussions to reflect on questions such as center/periphery, national form, and canon formation. The course objectives are to introduce students to current debates on the topic of world literature and to resplendent modern Chinese short stories, novellas, and plays. Taught in English.
Attribute/Distribution: CC, HU, W

MLL 191 Special Topics 1-4 Credits
Materials not covered by regularly taught courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

MLL 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, GERM 199, HEBR 199, JPNS 199, RUSS 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of languages, literatures, and culture courses not regularly taught at Lehigh University.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

MLL 202 (ENGL 202, GS 202, LAS 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HE, HU

MLL 231 (FILM 231, GERM 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films.
Attribute/Distribution: CC, HE, HU, W

MLL 256 (ASIA 256, HIST 256, WGSS 256) Women in Pre-Industrial China 4 Credits
This seminar focuses on the role of women as defined by medical, philosophical, legal, historical, religious, literary and other Chinese texts from ancient through early modern times. Attention is how women contributed to the evolution of traditional Chinese civilization and culture. The course materials are in English.
Attribute/Distribution: HE, HU, W

MLL 257 (ASIA 257, HIST 257, HMS 257) Traditional Chinese Medicine: Historical Perspectives 4 Credits
This seminar focuses on conceptions of the human body and health that evolved from the ancient through early modern times. Special attention is paid to healing strategies, the roles of healers and patients, and the evolution of a medical canon. The course materials are in English.
Attribute/Distribution: HE, HU, W

MLL 291 Special Topics 1-4 Credits
Materials not covered by regularly taught courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

MLL 299 (ARAB 299, ASIA 299, CHIN 299, FREN 299, GERM 299, HEBR 299, RUSS 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of languages, literatures, and other culture courses not regularly taught at Lehigh University.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

MLL 300 Apprentice Teaching 1-4 Credits

MLL 302 (ENGL 302, GS 302, LAS 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including "fantastic" narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: CC, HU

MLL 303 (ENGL 303, FILM 303, GERM 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: CC, HE, HU, W

MLL 312 (AAS 312, FREN 312) Modernity in the Maghreb 4 Credits
Emergence of the modern self through a comparative study of textual as well as visual representations of postcolonial subjects by male and female writers and film makers. Study of the way the sociopolitical context of countries such as Morocco, Algeria, and Tunisia informs the constitution of subjectivity within a multicultural and multilingual community. Issues such as patriarchy, nationalism, colonialism, postcolonialism, identity, gender, and Islam in North African literature and film from Franco-Arab traditions.
Attribute/Distribution: HU, W

MLL 389 (IR 389) IR/MLL Capstone Project 4 Credits
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an adviser in IR and one in the relevant language in MLL. Consent of department required.
Attribute/Distribution: CC, SS, W

MLL 391 Special Topics 1-4 Credits
Materials not covered by regularly taught courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

MLL 399 (ARAB 399, CHIN 399, FREN 399, GERM 399, HEBR 399, JPNS 399, RUSS 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of languages, literatures, or culture courses not regularly taught at Lehigh University.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

MLL 403 (WGSS 403) Grimms' Fairy Tales: Folklore, Feminism, Film 3 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany as well as Europe and America. Versions of "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in films and many forms of world literature. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.

Russian Courses

RUSS 001 Elementary Russian I 0,4 Credits
Classroom and laboratory, audio, and video introduction to the fundamentals of conversational and grammatical patterns; practice in pronunciation, simple conversation, reading, and writing.
Attribute/Distribution: AL, HU

RUSS 002 Elementary Russian II 4 Credits
Continuation of RUSS 001.
Attribute/Distribution: AL, HU

RUSS 011 Intermediate Russian I 4 Credits
Classroom and laboratory practice in conversation. Development of reading and writing skills.
Attribute/Distribution: AL, HU

RUSS 012 Intermediate Russian II 4 Credits
Continuation of RUSS 011.
Attribute/Distribution: AL, HU

RUSS 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

RUSS 092 Survival Russian 1 Credit
This one-credit course introduces students to the basics of the Russian language as a means of intercultural communication. The class combines asynchronous instruction with individually scheduled, hybrid practice sessions. Learn to decipher Cyrillic, manage cross-cultural work situations, be the "perfect" guest, and prepare to learn more in-country. Recommended for Global Impact Fellows in Kazakhstan. HU.
Attribute/Distribution: HU

RUSS 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, SPAN 099) Language & Culture Abroad I 0-8 Credits
Beginning level of Russian language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

RUSS 141 Russian Conversation and Composition I 4 Credits
Intensive practice in oral and written Russian and oral comprehension. Readings and discussions on Russian literature and culture.
Attribute/Distribution: AL, HU, W

RUSS 142 Russian Conversation and Composition II 4 Credits
Continuation of RUSS 141.
Attribute/Distribution: AL, HU, W

RUSS 180 Independent Study 1-4 Credits
Topics related to Russia or Russian language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

RUSS 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, SPAN 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Russian language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

RUSS 215 Russian Classics: Russian Literature with Variable Topic and Credit 1-4 Credits
Special topics in Russian Classic Literature.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

RUSS 280 Independent Study 1-4 Credits
Topics related to Russia or Russian language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 299 (ARAB 299, ASIA 299, CHIN 299, FREN 299, GERM 299, HEBR 299, MLL 299, SPAN 299) Language & Culture Abroad III 0-8 Credits
Advanced level of Russian language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 300 Apprentice Teaching 1-4 Credits

RUSS 370 Russian Internship 1-6 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in Russian-speaking countries. Assigned readings, written reports, and employer performance evaluations are required. Consent of faculty committee required.
Attribute/Distribution: CC, HU, W

RUSS 380 Independent Study 1-4 Credits
Topics related to Russia or Russian language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 389 Honors Project 1-8 Credits
An opportunity for students to undertake an honors project with consent of instructor.
Attribute/Distribution: CC, W

RUSS 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

RUSS 399 (ARAB 399, CHIN 399, FREN 399, GERM 399, HEBR 399, JPNS 399, MLL 399, SPAN 399) Language & Culture Abroad IV 0-8 Credits
Professional level of Russian language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Spanish Courses

SPAN 001 Elementary Spanish I 0,4 Credits
Basic conversational Spanish illustrating essential grammatical principles. Reading of simple texts and writing.
Attribute/Distribution: AL, HU

SPAN 002 Elementary Spanish II 0,4 Credits
Continuation of SPAN 1.
Attribute/Distribution: AL, HU

SPAN 011 Intermediate Spanish I 4 Credits
Limited review of elementary grammar concepts and introduction to more advanced grammar and vocabulary. Emphasis on discussion, reading, and writing about short literary works and current topics in the Spanish-speaking world.
Attribute/Distribution: AL, HU

SPAN 012 Intermediate Spanish II 4 Credits
Continuation of SPAN 011.
Attribute/Distribution: AL, HU

SPAN 091 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

SPAN 099 (ARAB 099, ASIA 099, CHIN 099, FREN 099, GERM 099, HEBR 099, JPNS 099, MLL 099, RUSS 099) Language & Culture Abroad I 0-8 Credits
Beginning level of Spanish language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

SPAN 141 Advanced Spanish Grammar 4 Credits
Intensive review of Spanish grammar with stress on finer points. Analysis of syntax and style. Improvement of grammar through composition. Heritage speakers should substitute with another 100-level class.
Attribute/Distribution: AL, HU, W

SPAN 142 Advanced Conversational Spanish 4 Credits
Conversational practice stressing the building of vocabulary based on literary texts and topics of general interest. Designed to stimulate fluent and spontaneous use of spoken Spanish. does not count toward completion of major.
Attribute/Distribution: AL, HU

SPAN 151 Cultural Evolution Of Spain 4 Credits
The historical and cultural evolution of Spain. Discussion of representative literary works in their cultural and historical contexts.
Attribute/Distribution: CC, HE, HU, W

SPAN 152 (LAS 152) Cultural Evolution of Latin America 4 Credits
The historical and cultural evolution of Latin America. Discussion of representative literary works in their cultural and historical contexts.
Attribute/Distribution: CC, HE, HU, W

SPAN 180 Independent Study 1-4 Credits
Topics related to Spanish and Hispanic Studies culture or language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 191 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, W

SPAN 199 (ARAB 199, ASIA 199, CHIN 199, FREN 199, GERM 199, HEBR 199, JPNS 199, MLL 199, RUSS 199) Language & Culture Abroad II 0-8 Credits
Intermediate level of Spanish language, literature, or culture courses taught abroad.
Attribute/Distribution: AL, CC, HE, HU, W

SPAN 211 (LAS 211) Business Spanish 4 Credits
An introduction to business concepts and vocabulary in Spanish. Specialized professional vocabulary and business culture in Spanish-speaking countries.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 212 Spanish Writing Skills 4 Credits
Improving writing proficiency through practice in composition and translation.
Prerequisites: SPAN 141
Attribute/Distribution: HU, W

SPAN 213 (FILM 213, LAS 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

SPAN 243 (LAS 243) Indigenous Cultures in Spanish America 4 Credits
A survey of Spanish American narratives that deal with the relationship between indigenous and occidental cultures. While examining works created from the late 19th century up until present day, we analyze the construction of cultural identity in several countries including Bolivia, Ecuador, and Mexico. Analysis will include works of poetry, short story, novel, essay, and film by several influential artists: Clorinda Matto de Turner, Jorge Icaza and José María Arguedas, to name just a few.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

SPAN 263 (LAS 263) The Spanish American Short Story 4 Credits
Comparative study of representative works by major writers such as Quiroga, Borges, and Cortazar, among others.
Attribute/Distribution: CC, HU, W

SPAN 265 (FILM 265, LAS 265) Spanish and Latin American Cinema 4 Credits
An introduction to cinema in the Spanish-speaking world. Oral discussion and written analysis of selected films. Students view films independently.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU, W

SPAN 270 (HMS 270, LAS 270) Spanish for the Health Professions 4 Credits
For prospective medical personnel communicating with Spanish-speaking patients. Healthcare vocabulary, patient-provider interaction, and cultural background of the Latino patient.
Prerequisites: SPAN 141
Attribute/Distribution: CC, HU

SPAN 280 Independent Study 1-4 Credits
Topics related to Spanish and Hispanic Studies culture or language not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 291 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 299 (ARAB 299, ASIA 299, CHIN 299, FREN 299, GERM 299, HEBR 299, MLL 299, RUSS 299) Language & Culture Abroad III 0-8 Credits
Advanced level of Spanish language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

SPAN 308 Literature, Theater, and Film of Post-War Spain 4 Credits
While Franco's dictatorship caste devastation on an already fragile nation, cultural production born from these oppressive years is some of the richest in modern Spanish history. In examining works by Carmen Laforet, Antonio Buero Vallejo, and Carlos Saura, among others, we will explore the ways in which the genres of literature, theater, and film worked to promote or contest ideologies during times of terror and censorship.
Attribute/Distribution: CC, HU, W

SPAN 320 (LAS 320) Literature of the Spanish Caribbean 4 Credits
Study of representative works with emphasis on Cuba and Puerto Rico. Writers include Barnet, Carpentier, and Rodriguez Juliá.
Attribute/Distribution: CC, HU, W

SPAN 324 Narratives of Crisis in Spain: 1898 to the Present 4 Credits
While the economic crisis in Spain has piqued international awareness, the concept of crisis itself is better understood in the larger frame of Spanish modernization. This course will study poetry, literature, and visual culture that attend to distinct moments of crisis that have shaped and contested the formation of Spain from the end of the nineteenth century to the present.
Attribute/Distribution: CC, HU, W

SPAN 325 (LAS 325) Hispanic Literature of The United States 4 Credits
Discussion of fiction, poetry, drama, and film from the main groups in the U.S. Hispanic population. Discussion of Hispanic ethnic identity, bilingualism, and minority issues.
Attribute/Distribution: CC, HU, W

SPAN 326 (LAS 326, WGSS 326) Tradition and Resistance: Women Writers of Latin America 4 Credits
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, and Cristina Peri Rossi, among others.
Prerequisites: SPAN 152
Attribute/Distribution: CC, HU, W

SPAN 379 Spanish Internship 2-4 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in Spanish-speaking countries or U.S. agencies serving the Hispanic community. Assigned readings, written reports, and employer performance evaluations are required. Students must be registered through an educational institution to receive credit. Consent of instructor required.
Attribute/Distribution: CC, HU, W

SPAN 380 Independent Study 1-4 Credits
Topics related to Spanish culture or language not covered in regular courses. There is not currently an independent study for students interested in material not covered in Spanish courses already listed in the Catalog.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 387 (LAS 387) Melodrama in Contemporary Spanish American Narrative 4 Credits
From the earliest works of Latin American narrative onward, melodrama has served as a fundamental tool for the structuring of dramatic conflict. Ranging from the programmatic social novel to the most parodic contemporary works, we will carefully examine the aims of melodramatic narration in works by Roberto Arlt and Mario Vargas Llosa, among others, as well as in various films and telenovelas.
Attribute/Distribution: CC, HU, W

SPAN 388 (FILM 388) The (Un)Translatable Spaces of Contemporary Spain 4 Credits
This seminar delves into the act of translation both as a nexus of comprehension between languages and cultures but also as a medium of signification of habits and ways of life in times of globalization. Concentrating specifically on contemporary Spain impacted by technological growth and economic stagnation, our seminar will examine works of art, literature, film, and poetry that bring to light the power of translation as well as its limits in the circulation of languages, customs, politics and cultures.
Repeat Status: Course may be repeated.
Prerequisites: SPAN 151
Attribute/Distribution: CC, HU, W

SPAN 389 Honors Project 1-8 Credits
An opportunity for students to undertake an honors project with consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

SPAN 391 Special Topics 1-4 Credits
Materials not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

SPAN 392 (LAS 392) The City and the Country in Spanish American Narrative 4 Credits
Across the history of the region defined as Latin America, urbanization, on the one hand, and the isolation of national interiors, on the other, have contributed to a problematic relationship between the city and the country. In examining works by the likes of Roberto Arlt, José Donoso, and Mario Bellatin, among others, this course examines the dialogue between the ostensibly separate environs of city and country, and questions they ways in which they influence one another.
Attribute/Distribution: CC, HU, W

SPAN 393 (LAS 393) The Boom and Beyond 4 Credits
This class will examine works from the so-called Boom of Spanish American literature in the 1960s alongside texts produced following this crucial moment of artistic and social change throughout Latin America. Moving from the Boom toward the postmodern, we will consider works by Gabriel García Márquez, Manuel Puig, and Mario Levrero, among others.
Attribute/Distribution: CC, HU, W

SPAN 399 (ARAB 399, CHIN 399, FREN 399, GERM 399, HEBR 399, JPNS 399, MLL 399, RUSS 399) Language & Culture Abroad IV 0-8 Credits
Professional level of Spanish language, literature, or culture courses taught abroad.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

Music

The Lehigh Music Department is devoted to the study, performance and appreciation of music, with a special commitment to collaboration across disciplines in the study of music as art and social practice. We offer a multiplicity of courses to educate our students in choral studies, composition, conducting, history, jazz, performance, recording technology, theory, and other subjects. We encourage majors and non-majors, undergraduates and graduate students alike to participate in our ensembles large and small, including choral groups, jazz orchestras and combos, marching band, philharmonic orchestra, string and wind ensembles, and symphonic band. Our students enjoy many opportunities to collaborate with renowned guest musicians, and we

employ a staff of illustrious instructors for students who wish to take private instrumental or vocal lessons.

Our department is located within the Zoellner Arts Center, and features a music library, practice rooms, a composition and digital class piano studio, a comprehensive recording studio, classrooms, rehearsal rooms, and a state-of-the-art concert facility, Baker Hall.

MAJOR PROGRAM

The Bachelor of Arts in Music program comprises three components: foundation courses, electives, and the capstone project. Foundation courses train students in music history and theory, as well as fundamental musicianship and performance skills. Together with a broad range of electives designed to help students identify individual areas of interest, these courses will give students the necessary skills and knowledge to develop the capstone projects that bring their academic efforts and ambitions to fruition.

The Music Major requires a minimum of 36 credits.

(1) Foundation		
MUS 005	Keyboard Skills	1
MUS 007	Aural Skills (or pass the aural proficiency exam)	1
MUS 081	Foundations of Music	3
MUS 082	Elementary Harmony	3
Two consecutive semesters of ensemble participation		0-2
(2) Electives [1]		
Two 100- or 200-level music courses that address any of the following areas: music genre, composer, conducting, composition, a historical period, or a specific historical-cultural topic.		6-8
All other music courses, lessons, and ensembles should be chosen in consultation with, and with the approval of, the undergraduate advisor and the capstone supervisor.		7-19
(3) Capstone		
MUS 270	Capstone Preparation	1-4
MUS 370	Capstone Project	1-4
Total Credits		**23-45**

[1] Additional electives may be needed to achieve a minimum of 36 credits for the major.

MINOR PROGRAM

The Music Minor enables students to take courses in music history and culture, participate in music ensembles, choose elective courses from a broad range of topics, and take private music lessons. The Music Minor requires a minimum of 17 credits.

(1) One course from the following:		3-4
MUS 010	Introduction to Western Music	
MUS 013	Music Cultures of the World	
MUS 081	Foundations of Music	
(2) Two consecutive semesters of ensemble participation		0-2
(3) One MUS course 3 credits or more		3-4
(4) Elective MUS courses, lessons, and ensembles		7-11
Elective courses, lessons, and/or ensembles are to be chosen in consultation with, and with the approval of, the undergraduate advisor.		

OPTIONS FOR MAJORING IN MUSIC

Lehigh attracts many engineering and science students, as well as English, business, and accounting majors, who wish to continue their active involvement in music. Those students who wish to combine their scientific or engineering pursuit with music should take a look at the Arts/Engineering program or at IDEAS. Beyond those curricula, students in engineering, business, or other majors can, with good time management, pursue either a dual degree or a double major. For more information on these two options, please see https://cas.lehigh.edu/content/double-majors-and-dual-degrees.

PRIVATE LESSONS

Lessons in most instruments and voice may be taken for one credit per semester; students may also enroll for no credit to avoid overloading. Lessons must be arranged through the department at set fees that are not included in tuition. Please note that registering for lessons does not guarantee availability, due to occasional difficulties in scheduling.

PERFORMING GROUPS

Admission to performing ensembles is by audition (except for Choral Union, Symphonic Band, and Marching 97, which are open to all students). Students receive one credit per semester by registering for the appropriate course number. Students may also register for zero credit, as indicated in the catalog. Although there is no limit to the number of these courses that may be taken, students should check with their advisor to determine the number of credits that may be applied toward graduation.

COURSE OFFERINGS

PLEASE NOTE: The course offerings are currently under revision and may not all be available at the time of registration.

Please see the Music Department Webpage (https://music.cas2.lehigh.edu/) for more information regarding Courses and Programs.

Courses

MUS 005 Keyboard Skills 1 Credit
For intended music majors only. Teaches keyboard competency including scales, prepared pieces, sight reading and other techniques. Leads to the Piano Proficiency exam requirement for all majors. Course may be repeated until Piano Proficiency exam is passed. A maximum of 2 credit hours may be counted toward the music major.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 007 Aural Skills 1 Credit
Intended for music majors and minors. This course focuses on singing, playing, and writing melodies/rhythms/harmonies in different tonalities and scales. It also explores chromaticism, mixed meters, singing and playing two-part music simultaneously, and singing together in parts. Course may be repeated until the Aural Proficiency exam is passed. A maximum of 2 credit hours may be counted toward the music major.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 010 Introduction to Western Music 3 Credits
Music can express that which cannot be said in words. This is part of the reason that it has been cherished in every culture in the history of humanity. By learning and applying active listening skills through a survey of Western Art Music, students develop an ability to think critically about music and to write intelligently about a wide range of musical experience. Intended for those not planning to major or minor in music.
Attribute/Distribution: HE, HU

MUS 013 Music Cultures of the World 3 Credits
An introduction to different musical styles, aesthetic, and humanistic approaches in understanding art, folk, traditional, and popular music of the world.
Attribute/Distribution: HE, HU

MUS 021 Marching Band 0,1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 022 Wind Ensemble 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 023 Symphonic Band 0,1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 024 Jazz Ensemble 0,1 Credits
Up to six credits may be used for graduation credit in CEAS and CBE. Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 027 Jazz Orchestra 0,1 Credits
Student/community/professional musicians performing classic, contemporary and original big band literature.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 031 University Choir 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 032 Choral Union 0,1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 033 Glee Club 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Corequisites: MUS 031
Attribute/Distribution: HU

MUS 034 Freshman Lab Choir 0,1 Credits
Admission by audition.
Attribute/Distribution: HU

MUS 035 Dolce Treble Choir 0,1 Credits
Members from university choir sing treble music.
Repeat Status: Course may be repeated.
Corequisites: MUS 031
Attribute/Distribution: HU

MUS 048 Chamber Music Collegium 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 049 Small Jazz Ensembles 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 061 Philharmonic Orchestra 0,1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 065 Class Guitar for Beginners 0,1 Credits
Beginning techniques and skills for guitar, either acoustic or electric. For students with less than a year of guitar instruction. Students supply their own instruments. Fees associated with course.
Attribute/Distribution: AL, HU

MUS 067 Class Drum Set for Beginners 0,1 Credits
Rudiments of drum set playing for students with less than a year of drum instruction. Fees associated with course.
Attribute/Distribution: AL, HU

MUS 068 Class Piano for Beginners 0,1 Credits
Instruction for beginning piano students, including rudiments of musical notation in relation to the keyboard; beginning pieces for solo piano and the group. Fees associated with course.
Attribute/Distribution: AL, HU

MUS 070 Private Drum Set Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 071 Private Piano Study 0,1 Credits
Up to six credits may be used for graduation credit in CEAS and CBE. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 072 Private Vocal Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 073 Private Classical String Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 074 Private Woodwind Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 075 Private Brass Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 076 Private Percussion Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 077 Private Organ Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 078 Private Acoustic Guitar 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 079 Private Electric Guitar Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 080 Private Electric Bass Guitar Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

MUS 081 Foundations of Music 3 Credits
Introduction to the fundamental elements of music: pitch and rhythm recognition, intervals, scales, keys, harmonies, etc. Overview of music histories, forms, and cultures. Close analysis of a piece or tradition of music from multiple perspectives. Students will learn how to attend, report on, and enjoy live concerts. Ability to read music is recommended.
Attribute/Distribution: HE, HU

MUS 082 Elementary Harmony 3 Credits
Exercises in writing in four-part chorale style. This includes all diatonic chords and non-harmonic tones. Elementary modulation and secondary dominants are introduced. Open to majors or non-majors.
Prerequisites: MUS 081
Attribute/Distribution: HU

MUS 083 Advanced Harmony 3 Credits
Continuation of Elementary Harmony – Includes advanced modulation, chromatic chords and harmony, and introduction to 20th century harmonic idioms. Course will prepare students continuing on to graduate school to take harmony exams for placement.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 120 Beethoven: The Composer as Hero 3 Credits
An introduction to Beethoven's life and works in the context of the rapid transformation of European Society and its systems of government and religion, from Enlightenment to Revolution to Early Romanticism.
Attribute/Distribution: CC, HE, HU, W

MUS 121 Master Works 1-4 Credits
Works of one or more composers studied in depth. Repeatable as course topic changes.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

MUS 122 Piano Literature 3 Credits
Survey of keyboard music from 1600 through today. Emphasis on major composers from Baroque, Classical, Romantic and Modern styles, as well as developments of keyboard instruments and their influence on compositional styles.
Attribute/Distribution: HE, HU, W

MUS 123 Symphonic Literature 3 Credits
A study of the history of orchestra literature from Baroque to the 21st Century, the orchestra as an ensemble and the orchestra as social construct.
Attribute/Distribution: HE, HU, W

MUS 125 Dark Romanticism in Music: The Sublime, the Uncanny, and the Psychological Confession 3 Credits
This course will examine works by Western classical music composers that were engaged with philosophical and emotional concepts of Romanticism in the nineteenth-century. As a response to the rational Enlightenment culture of the 1700s, composers wrote about the power of Nature, emotions, primitive instincts, and a fascination with the grotesque and gothic. In addition to listening to works, students will consider related works of visual art, literature and philosophical essays. They will be required to attend exhibits, lectures, performances.
Attribute/Distribution: CC, HE, HU, W

MUS 127 Elements of Jazz and Commercial Music 3 Credits
Introductory course intended for music majors, minors, and non music majors. A synopsis and exploration of the social history and musical foundations of jazz, and how they relate to contemporary popular music today. Knowledge of music is recommended.
Attribute/Distribution: HE, HU

MUS 128 (AAS 128) Jazz History I 3 Credits
A study of the roots of jazz. Starting in West Africa, the course traces the synthesis of African and European elements to 1945. Musicians covered are Gottshalk, Bolden, Morton, Armstrong, Hawkins, Basie, Ellington and others.
Attribute/Distribution: CC, HE, HU

MUS 129 (AAS 129) Jazz History II 3 Credits
A survey of modern jazz from 1945 to the present. Musicians covered include Parker, Gillespie, Monk, Davis, Coltrane, Hancock, and Coleman. Can be taken independently of Jazz History I, but the first course would be helpful.
Attribute/Distribution: CC, HE, HU

MUS 131 (ART 131) Music and the Creative Arts 3 Credits
This course examines collaborations, convergences and cross-influences between musicians, visual artists and other creatives in late 19th-early 20th century Europe and America. Students explore ways artists responded as individuals and collaborators, gain perspective on aesthetic movements including romanticism, realism, impressionism, symbolism, expressionism, futurism, dada, surrealism, and how these movements shaped the development of modernist culture. Students work with materials in the Music Department and LU Art Galleries teaching collection, studying the connections between music and visual works.
Attribute/Distribution: CC, HE, HU, W

MUS 132 The Soundtrack of Our Lives—History of American Popular Music 3 Credits
Popular music has always been intertwined with social, cultural and historical changes. This course examines pop music from the emergence of record labels in the early twentieth century to the present, which reflects the complicated history of race in the United States, while celebrating our shared triumphs and grieving our national tragedies. Students will read source materials, engage in active listening and discussion, and lead presentations on twenty-first century pop music.
Attribute/Distribution: HE

MUS 139 Jazz Theory I 3 Credits
Study of the Jazz/Commercial Music theory that is the foundation of a good jazz solo, composition or arrangement. A course designed to give instruction in basic chord progressions, functional analysis of jazz tunes, and ear training.
Prerequisites: MUS 081 and MUS 127
Attribute/Distribution: HU

MUS 140 Jazz Theory II 3 Credits
The course is designed as an in-depth exploration of the elements, origins and practical application of Jazz music theory.
Prerequisites: MUS 139
Attribute/Distribution: HU

MUS 141 Music Technology and Sound Recording 3 Credits
This course focuses on the fundamental concepts of sound recording technology and its correlations to the development of music genres and aesthetics in the social history of contemporary music. Students will learn to plan and complete a basic multitrack recording including tracking and mixing, be proficient in the set-up and operation of studio equipment, and develop a knowledge of different microphones, signal processors, and other recording technology in the context of different music genres and diverse socio-musical aesthetics.
Attribute/Distribution: AL, HU

MUS 142 Music Technology and Production 3 Credits
This course examines the process of creating a complete sound recording, including aspects of music business from the historical perspective of diverse contemporary music genres. Students will learn advanced skills for mixing multitrack recordings and the mastering techniques for recordings, advanced operational skills for digital audio workstations, and understand the processes of recording through publishing popular music in different social and musical contexts.
Prerequisites: MUS 141
Attribute/Distribution: AL

MUS 149 The String Quartet 3 Credits
The string quartet has often been the medium for Western composers' most complex and personal music. The course will examine the literature for the string quartet starting from the works of Haydn and ending with contemporary works by living American composers. In analyzing these works, the student should gain an understanding of the evolution of style in Western music through the lens of the string quartet, as well as understanding how the string quartet reflects the internal evolution of the.
Prerequisites: MUS 081
Attribute/Distribution: HE, HU

MUS 167 Class Drum Set for Intermediate Players 0-1 Credits
For students who have taken MUS 067:Beginner Drum Set Class. Fees associated with the course.
Prerequisites: MUS 067
Attribute/Distribution: HU

MUS 213 (ASIA 213) Drums and Gongs: Asian Musical Cultures 3 Credits
A study of Asian music history, theory, aesthetics, and cultures through hands-on performance workshops, lectures, and seminars.
Attribute/Distribution: HU

MUS 222 Conducting I 3 Credits
Beginning study of conducting techniques, conducting patterns, and gestures, with basic score reading, preparation, and analysis. Ability to read music is necessary; permission by instructor is required.
Attribute/Distribution: HU

MUS 238 History of Western Music before 1800 3 Credits
An exploration of the music and culture of Western civilization from its origins until the early 19th century. Each musical genre will be explored on the basis of its intrinsic characteristics as well as in connection with the aesthetic, social, philosophical, political, and economic environment in which it was created.
Prerequisites: MUS 081
Attribute/Distribution: HU, W

MUS 239 History of Western Music since 1800 3 Credits
An exploration of the music and culture of Western civilization from the early 19th century until the present. Each musical genre will be explored on the basis of its intrinsic characteristics as well as in connection with the aesthetic, social, philosophical, political, and economic environment in which it was created.
Prerequisites: MUS 081 or MUS 238
Attribute/Distribution: HU, W

MUS 240 Choral Writing 3 Credits
Study of choral composition, voicing, harmonization, writing to models, and original composition. Ability to read music is required.
Attribute/Distribution: HU

MUS 243 Compositional Practices from 1600-1900 4 Credits
The analysis and composition of pieces in the standard forms of the Baroque, Classical, and Romantic eras in Western music. Exercises in chromatic harmony. During the course students will write Chorale Variations, a Two-Part Invention, a Fugue, a Song, a Minuet, and an Intermezzo. They will analyze pieces in the following forms: Fugue, Variations, and Sonata Allegro.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 251 Special Topics 1-3 Credits
Study of musical topics in history or composition not covered in regular courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 253 Twentieth Century Composition and Orchestration 4 Credits
Writing for the standard Western orchestral instruments based on 20th century models. Use of the computer for score preparation and as a tool for music composition. Students will be required to purchase the Sibelius music-writing software.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 270 Capstone Preparation 1-4 Credits
Students will work closely with a faculty supervisor toward planning and implementing their final Capstone project in the areas of performance, composition, research thesis or some combination agreed upon. For Music Majors only. May be taken in the Junior year.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 291 Independent Study 1-3 Credits
Individually supervised work in history or composition, or continuation of projects begun in regular courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

MUS 322 Conducting II 3 Credits
A continuing study of conducting techniques, conducting patterns, and gestures, as well as score reading, preparation, and analysis. Ability to read music is necessary. Students should have taken MUS222 Conducting I, although commensurate conducting experience may be taken into consideration with the approval of the instructor.
Prerequisites: MUS 222
Attribute/Distribution: HU

MUS 370 Capstone Project 1-4 Credits
The Capstone Project is the final assessment for the music major in the areas of performance, composition, research thesis or a combination thereof as agreed with the faculty supervisor. For Music Majors only.
Repeat Status: Course may be repeated.
Prerequisites: MUS 270
Attribute/Distribution: HU

Philosophy

Department Home Page (https://philosophy.cas.lehigh.edu/)

At its heart, philosophy is concerned with how to lead our lives, with the difference between what matters and what only seems to matter, the difference between living and merely surviving. In different centuries and cultures, this central concern has been approached from very different points of view: from that of spiritual practices whether secular or religious, from that of one of the sciences such as economics or psychology, but always concerned with giving the best possible reasons for its answers to the existential question of how to lead our lives.

Perhaps it was the demand to give the best possible reasons that induced philosophy to invent a number of what can appear to be separate domains of philosophy conceived as a rigorous professional discipline.

- Logic addresses itself directly to the ways and patterns of reasoning.
- Ethics addresses itself to matters of right and wrong, justice and injustice.
- Political and legal philosophy approach those ethical issues tuned to a special concern for the political and legal contexts within which we live.
- Metaphysics is concerned with what exists and with what accounts for the being of whatever is.
- Epistemology is concerned with how we know what we know, or if we can ever know anything at all.
- Aesthetics is concerned with beauty in the arts, in nature, and in our lives.

However separate these different domains of philosophy can sometimes appear, they get their philosophical life blood from the existential concerns with which philosophy begins. These different philosophical domains are sometimes approached by reading culturally various historical texts, sometimes by investigating recent work in the various sciences of today. Sometimes a singular aspect of our lives together is addressed in ways developed by a few of these apparently separate philosophical domains: such is the case with bioethics, feminist philosophy, philosophy of race, of religion, of economics, of technology, of science, and of logic.

The study of philosophy is a work of the imagination. It teaches us how to think otherwise than within the constraints of what, in our habitual lives, mostly passes for thinking. That is why philosophy is a boon to work in any field, to life in any environment.

THE MAJOR PROGRAM

The major program in philosophy is designed to provide a broad exposure to the major areas of philosophy and a strong grounding in the history of philosophy. The program emphasizes the close reading and critical evaluation of classic texts from ancient times to the present, and students can expect to develop sophisticated analytic and expository skills that will enable them to engage in original, critical reflection on their own. The major program provides excellent preparation for graduate study in philosophy, law, and medicine, as well as a solid foundation for any career that places a premium upon clear, careful thinking, rigorous conceptual and analytical skills, and effective written and oral communication.

The major consists of a minimum of 44 credits in philosophy. There are 7 specified course requirements and 4 free elective courses of which 2 must be numbered 200 or above.

Major Requirements

Core Philosophy Requirements		
PHIL 014	Symbolic Logic	4
PHIL 102	Philosophical Thinking	4
PHIL 105	Ethics	4
PHIL 131	Ancient Philosophy	4
PHIL 135	Modern Philosophy	4
PHIL 139	Contemporary Philosophy	4
PHIL 220	Epistemology	4
or PHIL 221	Metaphysics	

Philosophy Electives

Select at least 16 additional credits of philosophy courses, of which at least 8 must be at the 200-level or above.	16
Total Credits	**44**

Writing-Intensive Requirement

Majors are strongly encouraged to fulfill their junior writing-intensive requirement by taking a WI-designated philosophy course.

HONORS

To qualify for Honors in Philosophy, philosophy majors must write an Honors Thesis.

The Honors Thesis is a year-long independent project during which philosophy majors, with the consent and under the guidance of a philosophy faculty advisor, investigate a topic of special interest to them. To be approved to work on an Honors Thesis, students should apply to the department in the spring of their junior year. Applications will detail the subject matter of the proposed thesis and a timeline for its completion; they will demonstrate that the student has secured the support of a faculty advisor who has determined that the student is philosophically able to complete the thesis.

If approved to write an Honors Thesis, the student will enroll in PHIL 390 Honors Thesis I (4 credits) in the first semester of their senior year and PHIL 391 Honors Thesis II (4 credits) in the second semester of their senior year. If the faculty advisor deems the student's progress towards completion of the thesis during the first semester (PHIL 390) unsatisfactory, the student will not be permitted to enroll in PHIL 391 for the second semester.

Departmental Honors in Philosophy are awarded to graduating seniors who satisfy the following two criteria:

1. At the start of their final semester, their overall GPA is at least 3.25 and their GPA in philosophy is at least 3.5, and
2. Their completed Honors Thesis receives an A from the thesis advisor, and then is judged by the whole department faculty to be well-researched, well-argued, well-organized, well-written, and to exhibit original philosophical thinking.

GRADUATE STUDY IN PHILOSOPHY

It is recommended that majors planning to pursue graduate study in philosophy (a) apply for Honors, (b) discuss their career plans with a faculty member during their junior year, and (c) make sure to include the following 4 specific courses in their programs:

PHIL 114	Metalogic	4
PHIL 220	Epistemology	4
PHIL 221	Metaphysics	4
PHIL 250	Philosophy of Mind	4
Total Credits		**16**

MINOR IN PHILOSOPHY

Minor programs are planned in conjunction with the departmental advisor who will help the student plan a program compatible with his or her interests.

The minor in philosophy consists of a minimum of 16 credits:

3 Philosophy courses at any level	12
1 Philosophy course at the 200-level or above	4
Total Credits	**16**

MINOR IN PHILOSOPHY, LAW & PUBLIC POLICY

Seldom in history have the philosophical foundations of law and public policy been more critically important. This minor is based on the idea that while law is codified policy, policy is persuasive philosophical-moral argument. Consequently, it begins from the premise that both a knowledge of established law, and those policy arguments that instigate transformation, require an understanding of the philosophical essence that gives a policy or law its authority. This makes the philosophical study of public affairs the most practical of endeavors. The new minor seeks, in a compact set of courses, to provide the student with the methodological and critical skills that are the core of philosophical understanding. In addition, the student will learn how to contextualize these skills through primary historical-philosophical sources, applying them to the analysis of those philosophical imperatives that currently drive the law, as well as the synthesis of legal-policy arguments for change.

Requirements: For those majoring in Philosophy, no more than one course can be counted toward both the major and this minor.

Core Course (select one)		**4**
PHIL/EVST 301	Philosophical-Policy & Legal Design: Methods & Applications	
PHIL 350	Special Topics In Philosophy, Law & Public Policy	
100-level courses (select two) [1]		**8**
PHIL 105	Ethics	
PHIL/REL/HMS 116	Bioethics	
PHIL 122	Legal Philosophy	
PHIL 125	Social & Political Philosophy	
PHIL/AAS 117	Race, Racism, and Philosophy	
PHIL 172	Philosophy of Economics	
One additional Philosophy course at the 200-level or above. [2]		**4**
Total Credits		**16**

1

A student may, with permission from the Philosophy Department, substitute a course from a different department in a germane subject for one of these courses.

2

A second core course can be taken to fulfill this requirement.

Courses

PHIL 001 Introduction to Philosophy 4 Credits
Philosophy is a broad discipline which critically addresses many different branches of human experience. Aesthetics, politics, ethics, religion and even the structure of the world have all represented great sources of philosophical discussion in both eastern and western traditions. Study of historical and contemporary texts will introduce students to this vast philosophical universe and provide the skills necessary to benefit from its further exploration. Course not open to seniors.
Attribute/Distribution: HE, HU, W

PHIL 003 (ETH 003, REL 003) Global Religion, Global Ethics 4 Credits
Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally in and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, vengeance).
Attribute/Distribution: HE, HU

PHIL 010 (ASIA 010, REL 010) Intro to Buddhism: Love Death and Freedom 4 Credits
This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism's Indian origins to its spread across Asia and globally. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and the forms of social and individual love and concern. Course materials include poetry, biographies, philosophical writings, art and film.
Attribute/Distribution: HE, HU

PHIL 014 (MATH 014) Symbolic Logic 4 Credits
This course is an introduction to logical theory. Our primary goal is to study the notions of logical consequence and provability. The central question that we will try to answer is this: What exactly does it mean to say that some conclusion is a logical consequence of or is provable from a certain collection of premises? To answer this question as clearly and rigorously as possible, we will develop three symbolic logical systems: Term Logic, Sentence Logic, and Predicate Logic.
Attribute/Distribution: MA, Q

PHIL 040 (REL 040) Is God Dead? Past, Present, Future 4 Credits
Is God Dead? Some people think so. Do you? Come decide for yourself. This course looks at the idea of god in Western philosophy and theology, with particular attention to death of god movement(s), and the changing shape of these movements in light of culture wars and identity politics. The course surveys key thinkers to ask questions about the origins, functions, and future of god and gods in the contemporary world. Posed as an ongoing question-Is god dead?
Attribute/Distribution: HU

PHIL 091 Special Topics 1-4 Credits
Introductory study of a subject in Philosophy not covered by other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

PHIL 100 (GS 100, POLS 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

PHIL 101 Ancient Political Heritage 4 Credits
Important Political thinkers from the pre-Socratics to early, modern political theorists like Machiavelli.
Attribute/Distribution: SS

PHIL 102 Philosophical Thinking 4 Credits
We can think philosophically about almost any topic: mathematics, ethics, ordinary objects, explanations, race, even philosophy itself. But if philosophy has no special subject matter, what exactly is it? Philosophy is a distinctive kind of activity - an activity that involves certain ways of thinking and certain kinds of conceptual tools. This class will familiarize students both with the tools philosophers take for granted and with philosophical patterns of reasoning and argumentative strategies that go beyond basic critical thinking.
Attribute/Distribution: HE, HU, W

PHIL 105 (ETH 105) Ethics 4 Credits
Examination of right and wrong, good and bad, from classic sources such as Plato, Aristotle, Hume, Kant, Mill and Nietzsche.
Attribute/Distribution: CC, HE, HU, W

PHIL 106 (ETH 106, HMS 106, REL 106) Bioethics and the Law 4 Credits
Students in this course will learn something about the foundations and (nontechnical) workings of the American system of justice, and will combine that understanding with a focus on various topics in bioethics, from the "right to die" to gene-patenting. A key point will be the understanding that, as science and medicine continually move forward, there are always new challenges to existing legal understanding. How should the law respond to new questions, e.g. inheritance rights of posthumously conceived children?
Attribute/Distribution: HU

PHIL 107 (HMS 107, REL 107) Bio-Ethics and the Family 4 Credits
From reproduction to dying, this course will focus on how ethical issues in science and medicine highlight the role of the family. Issues include assisted reproduction and the role of gamete donors; genetic testing and the problem of misattributed paternity; the locus of decision making when patients are terminal or in pvs. Should our individual-orientated medical culture move toward a more family-oriented perspective?
Attribute/Distribution: HU

PHIL 112 (ETH 112) Business Ethics 4 Credits
This course will explore moral problems that arise in the production and distribution of goods and services. Topics may include: the intersection of government and business, stakeholder vs stockholder theory, moral obligations of employers and employees, discrimination in the workplace, theories of ownership, fraudulent practices, cons and scams, and ethics in sales. (HU).
Attribute/Distribution: CC, HE, HU

PHIL 114 (MATH 114) Metalogic 4 Credits
This is a course on the metatheory of First-Order Predicate Logic. It offers expositions of some of the most important results of this metatheory, such as the Soundness and Completeness Theorems, Gödel's first and second Incompleteness Theorems, Tarski's Indefinability Theorem, and Church's Undecidability Theorem. It also offers introductory expositions of set theory, computability theory, and Second-Order Predicate Logic. The course is structured to serve the needs of a mixed audience, including students with no background in symbolic logic.
Attribute/Distribution: MA, Q

PHIL 116 (ETH 116, HMS 116, REL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: CC, HE, HU

PHIL 117 (AAS 117) Race, Racism, and Philosophy 4 Credits
An introduction to the philosophy born of struggle against racism and white supremacy. We will read the work of philosophers, mostly European, who quietly made modern racism possible by inventing the category of race, but we will concentrate on the work of philosophers, mostly of African descent, who for 200 years have struggled to force a philosophical critique of the category of race and the practice of white supremacy.
Attribute/Distribution: CC, HE, HU, W

PHIL 119 (ETH 119, EVST 119) Environmental Ethics 4 Credits
Evaluates the ethical and moral dimensions of humanity's relationship to nature as well as our individual and collective moral duties to confront urgent environmental challenges. Topics may include the intersection of climate and social justice; responsibilities to future generations, distant others, and nonhuman animals; the limitations of traditional ethical, political, and economic frameworks for accommodating our obligations and commitments to justice; and possible legal and public policy responses.
Attribute/Distribution: CC, HE, HU

PHIL 120 (FILM 120) Philosophy and Film 4 Credits
This seminar course will explore a variety of themes, genres, and movements within cinema from a philosophical perspective. Regular screenings of films from silent era to present. Content may vary depending upon instructor.
Attribute/Distribution: CC, HE, HU, W

PHIL 122 Legal Philosophy 4 Credits
This course will examine how philosophical argument is used to justify collective legal authority. It will focus on the dialectical relationship between the 'Ethical' definition of the moral in individual choice and the 'Juridical' definition of the moral in collective public law. Using legal cases, a cross-section of Medieval and Modern (Age of Reason-Enlightenment) Philosopher's arguments will be examined with special attention to their distinct definitions of human practical reason and moral agency, as these justify legitimate legal authority.
Attribute/Distribution: HE, HU, W

PHIL 123 Aesthetics 4 Credits
Theories, classical and modern, of the nature of beauty and the aesthetic experience. Practical criticism of some works of art, and examination of analogies between arts, and between art and nature.
Attribute/Distribution: HE, HU, W

PHIL 124 (REL 124) Philosophy Of Religion 4 Credits
Critical examination, from a philosophical perspective, of some fundamental problems of religion, the nature of religious experience and belief, reason and revelation, the existence and nature of God, the problem of evil, and religious truth.
Attribute/Distribution: CC, HE, HU, W

PHIL 125 Social & Political Philosophy 4 Credits
Examination of visions of good social life and values that should shape society so that people are able to live good lives together. Issues covered may include the nature of freedom, how the facts of gender, race, class, ethnic, and cultural differences should be taken into account in social and political relations, the limits of religious tolerance, war, world hunger.
Attribute/Distribution: CC, HE, HU, W

PHIL 127 Existentialism 4 Credits
Investigation of the historical development of existentialism from its origins in the 19th century (Kierkegaard, Nietzsche) through its marriage to phenomenology in the early 20th (Heidegger, Sartre, Merleau-Ponty), and out the other side as a vigorous dimension of much literary, psychological, and artistic work produced in the last 50 years.
Attribute/Distribution: HE, HU, W

PHIL 128 Philosophy Of Science 4 Credits
Science obviously works, and newer theories surely are better than the theories they replace, but why does science work, how does it work, and in what sense is it progressive? Is science a revelation of reality, or an account of evolving human experience? Are scientists rational? Is scientific reasoning logical? This course surveys the wide range of contemporary responses to these surprisingly elusive, and surprisingly still open, questions.
Attribute/Distribution: HE, HU

PHIL 129 (JST 129, REL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HE, HU, W

PHIL 131 Ancient Philosophy 4 Credits
Historical survey of selected texts and issues in the classical world, from the pre-Socratics through Aristotle, with emphasis on the origins of the western philosophical traditions in ethics, metaphysics, and epistemology.
Attribute/Distribution: HE, HU, W

PHIL 133 Medieval Philosophy 4 Credits
Historical survey of selected texts and issues in western philosophy from the fourth to 14th centuries. Attention will be given to the relation between developments in medieval philosophy and major currents in ancient and modern thought. Figures may include Augustine, Eriugena, Anselm, Aquinas, Ockham, and Nicholas of Autrecourt.
Attribute/Distribution: HE, HU

PHIL 135 Modern Philosophy 4 Credits
Historical survey of selected texts and issues in 17th and 18th century European philosophy with particular emphasis on developments in epistemology and metaphysics. Attention will be given to the relation of the “modern period” to developments in late medieval philosophy and the rise of the experimental sciences. Figures may include Descartes, Leibniz, Locke, Hume, and Kant.
Attribute/Distribution: HE, HU, W

PHIL 137 Nineteenth Century Philosophy 4 Credits
Historical survey of selected texts and issues in 19th century philosophy. Areas of focus may include post-Kantian idealism; period-specific critiques of religion, politics, and morality; theories of history; the origins of utilitarianism, pragmatism, existentialism, and mathematical logic; etc. Figures may include Hegel, Marx, Kierkegaard, Mill, Peirce, Frege, Nietzsche, James, etc.
Attribute/Distribution: HE, HU, W

PHIL 139 Contemporary Philosophy 4 Credits
Philosophical thought from the late 19th century to the present; pragmatism, linguistic analysis, existentialism, and Marxism. Truth and knowledge, values and moral judgment, meaning, the place of the individual in the physical world and society, and the impact of the scientific method upon all of these.
Attribute/Distribution: HE, HU, W

PHIL 140 (ASIA 140) Eastern Philosophy 4 Credits
Survey of selected texts and issues in the eastern philosophical traditions. Attention will be given to the development and interrelations of these traditions as well as a comparison of western and eastern treatments of selected issues. Areas of focus may include Confucianism, Taoism, and Zen Buddhism.
Attribute/Distribution: HE, HU

PHIL 141 (REL 141) Islamic Philosophy 4 Credits
The medieval era was the golden age of Islamic civilization. Science, mathematics, theology, philosophy, logic, jurisprudence, and many other disciplines flourished during that time. The course is an introduction to medieval Islamic philosophy. There is no indigenous Islamic philosophy other than medieval Islamic philosophy and theology, and commentaries on and interpretations of medieval Islamic philosophical and theological texts. The readings cover selections from the writings of al-Kind#, al-R#z#, al-F#r#b#, Ibn S#n# (Avicenna), al-Ghaz#l#, Ibn #ufayl, and Ibn Rushd (Averroes).
Attribute/Distribution: HE, HU

PHIL 142 (ASIA 142) Zen and Art of the Everyday 4 Credits
The Japanese conception of beauty is strikingly different to our own: it is associated with impermanence, imperfection, and austerity. Moreover, attention to beauty pervades even everyday activities in Japan, such as wrapping purchases at the dollar store or putting out garbage. This course explores principles that guide the Japanese aesthetic sensibility with an eye to its expression in Japanese literature, film, and traditional arts, such as the tea ceremony and gardening.
Attribute/Distribution: HE, HU

PHIL 145 Philosophy and Technology 4 Credits
This course is an exploration of questions of metaphysics and morality in the digital age. Are new technologies changing our views of metaphysics (what's real) and morality (what's right)? Can classical and contemporary philosophical theories help us think more clearly and make better choices when faced with new technologies? To help answer these questions, students will read a variety of philosophical works that invite critical reflection on a broad array of topics at the intersection of philosophy and technology.
Attribute/Distribution: CC, HE, HU, W

PHIL 146 (WGSS 146) Philosophy of Sex and Gender 4 Credits
An examination of concepts, values, and assumptions relevant to gender and sex(uality) in our diverse society, investigating how they affect our lives in both concrete and symbolic ways. Intersections among gender, sex(uality), race, class, religion, ethnicity, etc., will be explored. Special attention will be paid to how gendered assumptions color our understandings of experiences of embodiment and emotion, reasoning and decision-making, knowledge production, and public and private relationships and activities.
Attribute/Distribution: CC, HE, HU

PHIL 150 Philosophy of Education 4 Credits
A historical survey of major views on the meaning and function of education, this course will address questions such as, What is the role of education in individual human development? What are the goals of education? What are the ideal approaches to meet those goals? What is the relationship between one's view of learning and one's view of teaching? What is the relationship between educational institutions and the state? Does everyone need the same type of education?
Attribute/Distribution: CC, HE, HU, W

PHIL 151 (HMS 151, JST 151, REL 151) Judaism, Medicine, and Bioethics 4 Credits
This class traces the relationship between Jews and medicine from 1100 to 2020. How does Jewish religion and culture cultivate an affinity for the healing arts? How does Jewish law, ethics, and culture inform contemporary bioethics?
Attribute/Distribution: HE, HU

PHIL 155 Philosophical Foundations of International Law 4 Credits
What philosophical principles lay at the essence of such contemporary international legal dilemmas as terrorism, humanitarian intervention, refugee displacement and global warming? Can changing the principles used to understand these dilemmas affect prospects of peace, human rights and the cooperation of states? Building on the pillars of international law (its sources, the recognition and responsibility of states, and the law of jurisdiction and immunity), we'll examine the evolution of the idea of a 'law of nations' from Aquinas to Kant.
Attribute/Distribution: HE, HU, W

PHIL 171 Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic, designed in collaboration with a philosophy professor. Tutorial meetings, substantial written work. Consent of faculty instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 172 Philosophy of Economics 4 Credits
This course examines economic relations from a philosophical perspective. Topics include theories of property, labor, class, and markets in the history of philosophy as well as contemporary economic debates about distributive justice, commodification, gender, race, environmental sustainability, and the function of debt.
Attribute/Distribution: CC, HE, HU, W

PHIL 191 Special Topics 1-4 Credits
Study of a subject in Philosophy not covered by other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

PHIL 205 (ETH 205) Ethics Seminar 4 Credits
Advanced seminar in Ethics. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 207 Social & Political Philosophy Seminar 4 Credits
Advanced seminar in Social & Political Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 214 (MATH 214) Topics in Philosophical Logic 4 Credits
Topics may include the many systems of non-classical logic, truth theory, the impact of incompleteness and undecidability results on philosophy, the foundational projects of various philosophers/mathematicians, or the work of an important figure in the history of philosophical logic. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA, Q

PHIL 216 (ETH 216, HMS 216, REL 216) Research Ethics 4 Credits
Research with human and animal subjects carries with it a host of ethical and legal obligations. Topics include the history of human subjects research; ethical use of placebo studies; the ethics of research in developing countries; whether there is an ethical obligation to volunteer to be a research subject.
Attribute/Distribution: HU

PHIL 217 Race & Philosophy Seminar 4 Credits
Advanced seminar on Race and Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU

PHIL 220 Epistemology 4 Credits
Recent work in theories of knowledge. Questions addressed include: What is knowledge? How does it differ from mere opinion and belief? If you can't know whether you are dreaming, how can you know you have two hands? Can we know anything at all? Does knowledge require answers to all possible doubts or only reasonable doubts? How should we determine the horizon of the reasonable—psychologically or philosophically?
Attribute/Distribution: HE, HU, W

PHIL 221 Metaphysics 4 Credits
Metaphysics, the study of the basic structure of reality, seeks both to determine at a fundamental level what exists and what it means for something to be real, and to understand the nature of what exists, for example, whether what exists is mind-independent or depends on human thought. Topics might include social constructionism, universals and properties, identity and individuation, causation, necessity and possibility, realism and antirealism. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: HU, W

PHIL 223 Aesthetics Seminar 4 Credits
Advanced seminar in Aesthetics. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

PHIL 224 (REL 224) Topics in the Philosophy of Religion 4 Credits
Selected problems and issues in the philosophy of religion. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: CC, HU, W

PHIL 226 (WGSS 226) Feminism and Philosophy 4 Credits
Analysis of the nature, sources, and consequences of the oppression and exploitation of women and justification of strategies for liberation. Topics include women's nature and human nature, sexism, femininity, sexuality, reproduction, mothering. Student must have completed at least one Philosophy course at the 100-level, or one course in Women, Gender, and Sexuality Studies.
Attribute/Distribution: HU

PHIL 228 Philosophy of Specific Sciences 4 Credits
Advanced seminar in Philosophy of Physics or Philosophy of Biology or Philosophy of Psychology. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 233 Medieval Philosophy Seminar 4 Credits
Advanced seminar in Medieval Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 235 Modern Philosophy Seminar 4 Credits
Advanced seminar in Modern Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 237 Nineteenth Century Philosophy Seminar 4 Credits
Advanced seminar in Nineteenth Century Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

PHIL 239 Contemporary Philosophy Seminar 4 Credits
Advanced seminar in Contemporary Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 240 (ASIA 240) Eastern Philosophy Seminar 4 Credits
Advanced seminar in Eastern Philosophy. Content varies. Check department website for term-specific content. May be repeated for credit if the content differs. Student must have completed at least one Philosophy course at the 100-level.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU

PHIL 250 (COGS 250) Philosophy of Mind 4 Credits
An exploration of the mind-body problem. Are the body and mind distinct substances (dualism); or is there only body (materialism); or only mind (idealism)? Other views to be considered include behaviorism (the view that behavior can be explained without recourse to mental states), and the view that the mind is a complex computer. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: HE, HU

PHIL 251 (COGS 251) Philosophical Foundations of Cognitive Science 4 Credits
Cognitive Science is the study of aspects of natural and artificial minds: perception, cognition, reasoning, action, and language. Several fields intersect here: artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience. Central issues include: the nature of representation, the boundaries of cognitive science, and consciousness. We will survey the foundational philosophical aspects of these issues within Cognitive Science. Student must have completed at least one Philosophy course at the 100-level, or major in Cognitive Science.
Attribute/Distribution: HE, HU

PHIL 260 Philosophy of Language 4 Credits
A survey of some of the most central philosophical issues that relate to the structure and use of ordinary, as well as some logically ideal, languages. Issues such as the relation between linguistic expressions and reality, whether actual or hypothetical; between the meaning of expressions and thoughts; and between linguistic representations and truth. We will discuss such issues as understood in historically influential philosophical theories of language. Students must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: HE, HU

PHIL 265 Philosophy of Mathematics 4 Credits
A survey of the main philosophical views on the nature of mathematics and mathematical knowledge, including the classical debate between the logicist, formalist, and intuitionist schools, and the recent debate between realism and antirealism. Some of the material makes use of logical theory. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: HE, HU

PHIL 271 Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic designed in collaboration with a philosophy professor. Tutorial meetings; substantial written work. Student must have completed at least one Philosophy course at the 100-level. Consent of faculty instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

PHIL 292 Philosophical Methods 2 Credits
Methods of and approaches to philosophical research, reasoning, and writing, as preparation for senior thesis. Open only to junior philosophy majors. Department permission required.
Attribute/Distribution: HE, HU, W

PHIL 300 Apprentice Teaching 1-4 Credits
Attribute/Distribution: ND

PHIL 301 (EVST 301) Philosophical-Policy & Legal Design: Methods & Applications 4 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.
Attribute/Distribution: CC, W

PHIL 347 (REL 347) American Religious Thinkers 3-4 Credits
An examination of the writings of key figures in the history of American religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to the historical reception of these writings and to their contemporary significance.
Attribute/Distribution: HU, W

PHIL 350 Special Topics In Philosophy, Law & Public Policy 4 Credits
Themes, Techniques and Methods for the integration of Philosophy, Law and Public Policy. Considered from the standpoint of various core themes. These will change from offering to offering and may include, Healthcare, Bioethics, Race, Violence, The Market As An Allocation-Distribution Mechanism, Various Models of The State, and the juxtaposition between Constitutionalism and Democracy. May be repeated for credit as topic varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 364 (POLS 364) Issues In Contemporary Political Philosophy 3-4 Credits
Selected topics in contemporary political philosophy, such as the Frankfurt school, existentialism, legitimation, authenticity, participatory democracy, and the alleged decline of political philosophy.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PHIL 367 (POLS 367) American Political Thought 3-4 Credits
Critical examination of American political thought from the founding of the Republic to the present. Writings from Madison, Hamilton, and Jefferson to Emma Goldman, Mary Daly, Malcolm X, Henry Kariel, and others will be discussed.
Attribute/Distribution: SS

PHIL 371 Advanced Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic designed in collaboration with a philosophy professor. Tutorial meetings; substantial written work. Student must have completed at least one Philosophy course at the 200-level or higher, and have consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

PHIL 390 Honors Thesis I 4 Credits
The first part of two semesters of intensive research and writing supervised by the philosophy faculty thesis advisor in anticipation of completing an honor's thesis in philosophy. Individual tutorials; substantial written work. Senior standing as a philosophy major and permission of the faculty advisor and permission of the philosophy department required.
Attribute/Distribution: HU, W

PHIL 391 Honors Thesis II 4 Credits
Continuation and completion of PHIL 390 under the guidance of the thesis advisor. Consent of thesis advisor required.
Prerequisites: PHIL 390
Attribute/Distribution: HU, W

Physics

Physics students study the basic laws of mechanics, heat and thermodynamics, electricity and magnetism, optics, relativity, quantum mechanics, and elementary particles. Students also study applications of the basic theories to the description of bulk matter, including the mechanical, electric, magnetic, and thermal properties of solids, liquids, gases, and plasmas, and to the description of the structure of atoms and nuclei. In addition, students develop the laboratory skills and techniques of the experimental physicist, skills that can be applied in the experimental search for new knowledge or in applications relating to known theories.

A majority of physics graduates go to graduate school in physics, often earning the Ph.D. degree. These graduates take university or college faculty positions, or work on research in a variety of university, government, or industrial laboratories. Some students choose employment immediately after the bachelor's degree. They use their many approved and free electives to supplement their science background with applied courses, such as engineering, to develop the skills needed for a position in a particular area.

Because of the fundamental role of physics in all natural sciences, students also use the physics major as an excellent preparation for graduate study in many other scientific areas, such as optical engineering, applied mathematics, computer science, biophysics, molecular biology, astrophysics, geology and geophysics, materials science and engineering, meteorology, or physical oceanography. Attractive engineering areas with a high science content include optical communications, aeronautical engineering, nuclear engineering, including both fission and fusion devices; electrical engineering, including instrumentation; electronics and solid-state devices, electrical discharges and other plasma-related areas; and mechanical engineering and mechanics, including fluids and continuum mechanics. The broad scientific background developed in the physics curriculum is also an excellent background for professional schools, such as law (particularly patent law), medicine, and optometry.

Lehigh offers three undergraduate degrees in physics and two undergraduate degrees in astronomy or astrophysics. The three physics degrees are the bachelor of arts with a major in physics and the bachelor of science in physics in the College of Arts and Sciences, and the bachelor of engineering physics in the College of Engineering and Applied Science. The B.A. with a major in astronomy and the B.S. in astrophysics are in the College of Arts and Sciences and are described in the **Astronomy and Astrophysics** section of this catalog.

In addition, there are several five-year, dual-degree programs involving physics: The Arts-Engineering program (see the **Arts-Engineering** section of this catalog), the combination of the bachelor of science program in the College of Arts and Sciences with electrical engineering (described below), and the combination of electrical engineering and engineering physics (see the **Electrical Engineering and Engineering Physics** section of this catalog).

The bachelor of science curriculum in the College of Arts and Sciences requires somewhat more physics and mathematics than the bachelor of arts major, while the latter provides more free electives and fewer hours for graduation. By making good use of the electives in these programs, students can pursue graduate work in physics or physical aspects of other science or engineering disciplines, or technical careers requiring a basic knowledge of physics. The bachelor of arts curriculum is particularly useful for those planning careers in areas where some knowledge of physics is needed or useful, but is not the main subject, such as science writing, secondary school teaching, patent law, or medicine. The bachelor of science in engineering physics curriculum in the College of Engineering and Applied Science requires an engineering concentration in either solid state electronics or optical sciences, in addition to regular physics and mathematics courses. This four-year program prepares students to do engineering work in an overlap area between physics and engineering. This may involve engineering in a forefront area in which it is desirable to have more physics knowledge than that typically provided in an engineering program. It may be a field of experimental physics which either relies heavily on forefront engineering or in which the nature of the problem dictates that scientists and engineers will accomplish more working together rather than separately.

Requirements and recommended course sequences are described below for programs in the College of Arts and Sciences and in the P. C. Rossin College of Engineering and Applied Science. Note that no more than 6 credits of military science may be applied toward any degree program.

COLLEGE OF ARTS AND SCIENCES

B.A. with Major in Physics Program Requirements

PHY 010	General Physics I	4
or PHY 011	Introductory Physics I	
PHY 013	General Physics II	3-4
or PHY 021	Introductory Physics II	
PHY 012	Introductory Physics Laboratory I	1
PHY 022	Introductory Physics Laboratory II	1
PHY 031	Introduction to Modern Physics	3
PHY 220	Advanced Physics Laboratory I	3
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
CHM 030	Introduction to Chemical Principles	4
Select at least 6 of the following:		18
PHY 212	Electricity and Magnetism I	
PHY 213	Electricity and Magnetism II	
ASTR 301	Introduction to Stellar Astrophysics	
PHY 215	Classical Mechanics I	
PHY 332	High-Energy Astrophysics	
PHY 340	Thermal Physics	
PHY 342	General Relativity	
PHY 348	Plasma Physics	
PHY 352	Modern Optics	
PHY 355	Nonlinear Optics	
PHY 362	Quantum Mechanics I	
PHY 363	Physics of Solids	
PHY 364	Nuclear and Elementary Particle Physics	
PHY 365	Physics Of Fluids	
PHY 369	Quantum Mechanics II	
PHY 380	Introduction to Computational Physics	
Total Credits		**52-53**

A total of 120 credits are required for the BA in Physics

B.S. in Physics Program Requirements

Mathematics Courses		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
MATH 208	Complex Variables	3-4
or MATH 320	Ordinary Differential Equations	
or MATH 322	Methods of Applied Analysis I	
Basic Science Courses		
PHY 011	Introductory Physics I	4
or PHY 010	General Physics I	
PHY 021	Introductory Physics II	0,4
PHY 012	Introductory Physics Laboratory I	1
PHY 022	Introductory Physics Laboratory II	1
PHY 031	Introduction to Modern Physics	3
CHM 030	Introduction to Chemical Principles	4
Laboratory and Computing Courses		

CSE 003	Introduction to Programming, Part A	2
or CSE 007	Introduction to Programming	
PHY 220	Advanced Physics Laboratory I	3
PHY 221	Advanced Physics Laboratory II	2
*Or an equivalent course in scientific computing.		
Intermediate and Advanced Courses		
PHY 212	Electricity and Magnetism I	3
PHY 213	Electricity and Magnetism II	3
PHY 215	Classical Mechanics I	4
PHY 340	Thermal Physics	3
PHY 362	Quantum Mechanics I	3
PHY 364	Nuclear and Elementary Particle Physics	3
PHY 369	Quantum Mechanics II	3
Elective Courses		**15**
Select five Physics or Astronomy courses numbered higher than 100. Up to two courses in appropriate technical areas offered in other departments may be substituted, when selected with advisor approval. Students planning graduate work in physics are encouraged to include PHY 273 (Research) among their electives.		
Total Credits		**75-80**

A total of 123 credits are required for the BS in Physics

RECOMMENDED SEQUENCE OF COURSES

The recommended sequence of courses for physics degree programs are indicated below. General electives are not indicated, but they should be selected in consultation with the advisor so that educational goals and total credit hour requirements are satisfied.

B.A. with a Major in Physics, College of Arts & Sciences

First Year

Fall	CR	Spring	CR
WRT 001	3	WRT 002	3
Big Questions Seminar	3-4	CHM 030	4
PHY 010 or 011	4	MATH 022	4
PHY 012	1	Dist. Req.	4
MATH 021	4		
	15-16		**15**

Second Year

Fall	CR	Spring	CR
PHY 013 or 021	3-4	PHY 031	3
PHY 022	1	MATH 205	3
MATH 023	4	Elective	6-7
Dist. Req.	8	Dist. Req.	4
	16-17		**16-17**

Total Credits: 62-65

B.S. in Physics, College of Arts & Sciences

First Year

Fall	CR	Spring	CR
WRT 001	3	WRT 002	3
Big Questions Seminar	3-4	CHM 030	4
PHY 011 or 010	4	MATH 022	4
PHY 012	1	Distribution Requirement	3-4
MATH 021	4		
	15-16		**14-15**

Second Year

Fall	CR	Spring	CR
PHY 021	4	PHY 031	3
PHY 022	1	CSE 003 or 007	2-4
MATH 023	4	MATH 205	3
Dist. Req.	3-4	Dist. Req.	3-4
Elective or Dist. Req.	3-4	Elective or Dist. Req.	3-4
	15-17		**14-18**

Total Credits: 58-66

*

Or an equivalent course in scientific computing.

P.C. ROSSIN COLLEGE OF ENGINEERING & APPLIED SCIENCES

Both concentrations require 131 credit hours. The tables below indicate both course requirements and recommended enrollment sequences.

Bachelor of Engineering Physics
with a concentration in Solid State Electronics

First Year

Fall	Credits	Spring	Credits
WRT 001	3	WRT 002	3
PHY 011 & PHY 012	5	CHM 030	4
MATH 021	4	MATH 022	4
ENGR 005	2	ENGR 010	2
		HSS	3
	14		**16**

Second Year

Fall	Credits	Spring	Credits
PHY 021 & PHY 022	5	PHY 031	3
MATH 023	4	MATH 205	3
ECO 001	4	MATH 208	3
ECE 081	4	ECE 123	3
		HSS	4
	17		**16**

Third Year

Fall	Credits	Spring	Credits
PHY 212	3	PHY 213	3
PHY 220	3	PHY 221	2
ECE 033	4	PHY 215	4
ECE 108	4	ECE 126	3
MATH 322	3	HSS	3
		Elective	3
	17		**18**

Fourth Year

Fall	Credits	Spring	Credits
PHY 340 or ME 104	3	HSS	3
PHY 363	3	SSE -Elec (1)	8
PHY 362	3	Electives	6
SSE –Elec	3		
Elective	4		
	16		**17**

Total Credits: 131

(1)

The 11 credit hours of SSE (Solid State Engineering) electives must include ECE 257 or ECE 258 or PHY 273.
Other advanced physics or engineering courses may be included among the SSE electives with the approval of the student's advisor.

with a concentration in Optical Sciences

First Year			
Fall	**Credits**	**Spring**	**Credits**
WRT 001	3	WRT 002	3
PHY 011 & PHY 012	5	CHM 030	4
MATH 021	4	MATH 022	4
ENGR 005	2	ENGR 010	2
		HSS	3
	14		**16**

Second Year			
Fall	**Credits**	**Spring**	**Credits**
PHY 021 & PHY 022	5	PHY 031	3
MATH 023	4	MATH 205	3
ECO 001	4	MATH 208	3
ECE 081	4	HSS	4
		OE- Elec (1)	3
	17		**16**

Third Year			
Fall	**Credits**	**Spring**	**Credits**
PHY 212	3	PHY 213	3
PHY 220	3	PHY 221	2
PHY 362	3	PHY 215	4
ECE 108	4	OE –Elec	3
MATH 322	3	HSS	3
		Elective	3
	16		**18**

Fourth Year			
Fall	**Credits**	**Spring**	**Credits**
PHY 340 or ME 104	3	PHY 355	3
PHY 352	3	Electives	4
OE –Elec	6	OE –Elec	6
Electives	6	HSS	3
	18		**16**

Total Credits: 131

(1)
The 18 credit hours of OE (Optical Engineering) electives must include ECE 257 or ECE 258 or PHY 273. Must include at least two of ECE 347, ECE 348, ECE 371, ECE 372.
Other advanced physics or engineering courses may be included among the OE electives with the approval of the student's advisor.

COMBINED B.S.(PHYSICS)/B.S.(ELECTRICAL ENGINEERING)

The combined arts/engineering programs resulting in bachelors degrees in both physics and electrical engineering may be arranged so that either of the two degrees is completed within the first four years. The suggested curricula are:

Physics-Elec. Engr (Physics first)

First Year			
Fall	**CR**	**Spring**	**CR**
WRT 001	3	WRT 002	3
PHY 011 & PHY 012	5	CHM 030	4
MATH 021	4	MATH 022	4
ENGR 005	2	ENGR 010	2
		Distribution Requirement	3
	14		**16**

Second Year			
Fall	**CR**	**Spring**	**CR**
PHY 021 & PHY 022	5	PHY 031	3
MATH 023	4	ECO 001	4
ECE 033	4	MATH 205	3
ECE 081	4	MATH 208	3
		HSS/Dist. Req.	4
	17		**17**

Third Year			
Fall	**CR**	**Spring**	**CR**
PHY 212	3	PHY 213	3
PHY 362	3	PHY 221	2
ECE 108	4	PHY 364	3
ECE 182	1	PHY 215	4
MATH 322	3	ECE 121	2
Jr. Writing	3	ECE 123	3
	17		**17**

Fourth Year			
Fall	**CR**	**Spring**	**CR**
PHY 340	3	ECE 126	3
PHY Appr. Elective	6	ECE 138	2
HSS/Dist. Req.	6	ECE 125	3
Elective	3	PHY Appr. Elective	6
		HSS/Dist. Req.	3
	18		**17**

Fifth Year			
Fall	**CR**	**Spring**	**CR**
ECE 257	3	ECE 258	2
MATH 231	3	ECE Appr Elective	9
ECE 136	3	Elective	3
ECE Appr Elective	3		
Elective	3		
	15		**14**

Total Credits: 162

Elec. Engr-Physics (Electrical Engineering First)

First Year			
Fall	**CR**	**Spring**	**CR**
WRT 001	3	WRT 002	3
PHY 011 & PHY 012	5	CHM 030	4
MATH 021	4	MATH 022	4
ENGR 005	2	ENGR 010	2
		HSS/Dist. Req.	4
	14		**17**

Second Year			
Fall	**CR**	**Spring**	**CR**
PHY 021 & PHY 022	5	PHY 031	3
MATH 023	4	ECE 121	2
ECE 033	4	MATH 205	3
ECE 081	4	ECE 123	3

		HSS/Dist. Req.	6
	17		**17**

Third Year

Fall	CR	Spring	CR
PHY 212	3	PHY 213	3
ECE 108	4	ECE 126	3
ECE 182	1	ECE 138	2
MATH 208	3	ECE 125	3
MATH 231	3	ECO 001	4
Jr. Writing	3		
	17		**15**

Fourth Year

Fall	CR	Spring	CR
PHY 362	3	PHY 364	3
ECE 136	3	PHY 215	4
ECE 257	3	ECE 258	2
ECE Appr. Elective	6	ECE Appr. Elective	6
		HSS/Dist. Req.	3
	15		**18**

Fifth Year

Fall	CR	Spring	CR
PHY 340	3	PHY 221	2
MATH 322	3	PHY Appr Elective	3
PHY Appr Elective	6	Electives	12
Electives	3		
	15		**17**

Total Credits: 162

Physics approved electives

Select three of the following:		9
PHY 363	Physics of Solids	
PHY 369	Quantum Mechanics II	
PHY 352	Modern Optics	
or PHY 355	Nonlinear Optics	
PHY 348	Plasma Physics	
or PHY 365	Physics Of Fluids	
PHY 380	Introduction to Computational Physics	
Total Credits		**9**

Students must satisfy both the HSS requirements of the College of Engineering and Applied Science and the distribution requirements, including the junior writing intensive requirement, of the College of Arts and Sciences. Courses appropriate for both may be counted in both categories.

Approved electives are subject to the approval of the student's advisor. Students planning graduate work in physics are advised to include PHY 273 and PHY 369 among their electives.

ASTRONOMY/ASTROPHYSICS DEGREE PROGRAMS

(See the Astronomy (p. 85) section in this catalog.)

RESEARCH OPPORTUNITIES

A majority of physics, astronomy, and engineering physics majors take advantage of opportunities to participate in research under the direction of a faculty member. Research areas available to undergraduates are the same as those available to graduate students; they are described below under the heading For Graduate Students. Undergraduate student research is arranged informally as early as the sophomore (or, occasionally, freshman) year at the initiation of the student or formally as a senior research project. In addition, a number of students receive financial support to do research during the summer between their junior and senior years, either as Physics Department Summer Research Participants or as Sherman Fairchild Scholars.

The use of electives

The electives available in each of the physics and astronomy curricula provide the student with an opportunity to develop special interests and to prepare for graduate work in various allied areas. In particular, the many available upper-level physics, mathematics, and engineering courses can be used by students in consultation with their faculty advisors to structure programs with special emphases in a variety of areas such as optical communications, solid-state electronics, or biophysics.

DEPARTMENTAL HONORS

Students may earn departmental honors by satisfying the following requirements:

- Grade point average of at least 3.50 in physics courses.
- Complete 6 credits of PHY 273 (research), or summer REU project, submit a written report, and give an oral presentation open to faculty and students.
- Complete three courses from the list:
- Select one of the following: 3

PHY 332	High-Energy Astrophysics	
PHY 342	General Relativity	
PHY 348	Plasma Physics	3
PHY 363	Physics of Solids	3
PHY 352	Modern Optics	3
or PHY 355	Nonlinear Optics	
PHY 369	Quantum Mechanics II	3
PHY 380	Introduction to Computational Physics	3

Any 400 level Physics course

For students majoring in astronomy or astrophysics, see the **Astronomy and Astrophysics** section of this catalog.

FIVE-YEAR COMBINED BACHELOR/MASTER'S PROGRAMS

Five-Year programs that lead to successive bachelor and master's degrees are available. These programs satisfy all of the requirements of one of the five bachelor's degrees in physics (B.A., B.S., B.S.E.P.) and astronomy/astrophysics (B.A., B.S.), plus the requirements of the M.S. in physics in the final year. Depending upon the undergraduate degree received, one summer in residence may be required. Interested students should contact the associate chair of physics no later than the spring semester of their junior year for further detail.

THE MINOR PROGRAM

The minor in physics requires 15 credits of Physics and Astronomy courses. These must include PHY 031, plus at least 6 credit hours at the 100 level or above. No more than one course required for a student's major program can be counted towards the number of credits for the physics minor. The minor program must be approved by the physics department chair or undergraduate advisor to ensure a coherent intellectual theme. Examples of course sequences for the minor program can be found on the Physics Department WebSite.

FOR GRADUATE STUDENTS

The department of physics has concentrated its research activities within several fields of physics, with the result that a number of projects are available in each area. Current departmental research activities include the following:

Astronomy and Astrophysics. Current research involves theoretical and observational studies of stars and planets. Particular areas of interest in stellar astrophysics are young open clusters, binary stars, X-ray binaries, the formation of disks in Be stars, and stellar pulsations. Research on planets involves the discovery and characterization of exoplanets orbiting bright stars and the search for extraterrestrial life.

Atomic, Molecular, and Optical Physics. Current research investigates the physics of quantum many-body systems through studies of ultracold atomic gases. Topics include superfluidity, spin and heat transport, and thermodynamics of strongly interacting Fermi

gases. Experiments employ laser cooling and optical trapping to produce quantum degenerate atomic gases, and tailored optical potentials, radiofrequency spectroscopy and other techniques to perform measurements. Research also includes thermalization and condensation of photons in dye media confined within a narrow optical cavity.

Biophysics. Researchers in the physics department employ experimental as well as mathematical and computational modeling to study the organization and dynamics of biological systems. They are involved in interdisciplinary collaborations with researchers in biology, bioengineering and related fields. Areas of research involve experimental and theoretical studies of mechanical properties of cells and biomaterials using techniques such as optical tweezers and optical microscopy; modeling studies of cell division, cell motion, polarized growth, and mating; physics of cytoskeletal self-organization; and experimental study of lipid membranes using microfluidics and confocal microscopy.

Computational Physics. Many of the fields of physics research at Lehigh involve the use of state-of-the-art computers to address large-scale computational problems. Researchers in the physics department employ computational approaches to model complex many-body systems in condensed matter, biological, and quantum systems; the detection of variable signals in large astronomical surveys; coarse-grained models of biological systems with molecular dynamics, statistical, and continuum methods. The computational research is performed at both high performance computing facilities on campus and in national facilities.

Condensed Matter Physics. Areas of interest include the optical and electronic properties of defects in semiconductors and insulators; collective dynamics of disordered solids; structural phase transitions in ferroelectrics and superconducting crystals; organic molecular crystals; exciton dynamics, singlet-triplet conversion, and in general the physics of electronic and optoelectronic devices; the quantum physics of matter, fields, and their interactions at the nanoscale; surfaces, interfaces and heterostructures; emergent physics in low-dimensional materials; strongly correlated electronic systems, topological phases of matter, unconventional superconductivity, and classical and quantum phase transitions.

High Energy Nuclear Experimental Physics. Current research involves the study of relativistic heavy-ion collisions at the Solenoidal Tracker at RHIC (STAR) and sPHENIX experiments at Brookhaven National labs. This field of research focuses on the study of matter under extreme conditions of temperature, density, and pressure, where the quarks and gluons that make up normal nuclear matter are no longer confined into hadrons. This deconfined matter is called the quark gluon plasma (QGP), and experiments use high-energy probes, such as particle jets and heavy flavor quarks, to determine how quarks and gluons lose energy in this medium.

High Energy Theory. String theory, quantum field theory and cosmology. Areas of interest include the connection between gravitational theories and quantum field theories, holographic gauge/gravity dualities, the behavior of strongly correlated quantum phases of matter, and the evolution of the early universe.

Nonlinear Optics and Photonics. Research topics include nonlinear light-matter interaction that enables the control of light with light, four-wave mixing, phase conjugation, and wavelength conversion. We develop materials for second- and third-order nonlinear optics in particular organic molecular assemblies, and in general study materials and effects for photonics and optoelectronics. Examples include single crystals in glass, photonic crystals, holey and other specialty fibers, waveguides, resonant Brillouin scattering, and ferroelectric domain patterning for quasi phase matching. There is also considerable work on applications of photonics to biological systems, near-field optics, and thermal radiation.

Plasma Physics. Laboratory studies of collisional and collisionless phenomena in supercritical laser-produced plasmas. Laboratory simulation of supernova emissions in the mid-infrared by excitation of interstellar nano-crystallites by strong shock waves in a new cryogenic diaphragm-less shock tube facility

Soft Condensed Matter and Complex Fluids. Biopolymer networks, biomembranes, and colloidal suspensions are investigated using experimental techniques such as confocal microscopy, laser tweezers, electro-osmotic control, microfluidics, in combination with image analysis and computational modeling. Research areas include phase separation on cell membranes, microrheology of macromolecules and living cells, generalized sedimentation equilibrium of colloidal suspensions, active colloidal suspensions far from equilibrium, diffusion in complex and/or crowded environments, and formation and evolution of nanoscale complexes in solutions.

Statistical Physics. Research includes equilibrium and nonequilibrium fluctuations in gases and liquids; genesis and dynamics of disorder in 2-D solids near percolation threshold; and modeling of transport in disordered metallic solids under thermal forcing.

Candidates for advanced degrees normally will have completed, before beginning their graduate studies, the requirements for a bachelor's degree with a major in physics, including advanced mathematics beyond differential and integral calculus. Students lacking the equivalent of this preparation will make up deficiencies in addition to taking the specified work for the degree sought.

At least eight semester hours of general college physics using calculus are required for admission to all 200- and 300-level courses. Additional prerequisites for individual courses are noted in the course descriptions. Admission to 400-level courses generally is predicated on satisfactory completion of corresponding courses in the 200- and 300-level groups or their equivalent.

FACILITIES FOR RESEARCH

Research facilities are housed in the Sherman Fairchild Center for the Physical Sciences, containing Lewis Laboratory, the Sherman Fairchild Laboratory for Solid State Studies, and a large connecting research wing. Resources include a machine shop, electronics shop, and networked computer facilities.

Lehigh researchers in astrophysics are involved in a number of worldwide astrophysics surveys and collaborations, including the KELT exoplanet survey, the NASA K2 and TESS missions, LSST, and WFIRST. Lehigh researchers in experimental high energy nuclear physics participate in collaborations affiliated with the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Lab. These include the Solenoidal Tracker at RHIC (STAR) and the sPHENIX collaborations.

Instruments used for experimental studies include a wide variety of laser systems, spectrometers, and microscopes. Examples include femtosecond and picosecond pulsed and dye lasers, various spectrometers (Raman and Fourier-transform), a facility for luminescence microscopy, a cell culture facility, and a laser-tweezers system for studies of cells and complex fluids. The Fairchild Laboratory also houses a processing laboratory where advanced Si devices can be fabricated and studied.

Several physics professors are also members of interdisciplinary initiatives that offer a wide range of state-of-the art facilities including a fiber drawing tower, waveguide and fiber characterization labs, and a new epitaxy facility for the growth of III-V semiconductor structures and devices. World-class electron microscopy facilities are also available. Members of the physics department also participate in Lehigh's Emulsions Polymer Institute, the Institute for Functional Materials and Devices, and the Institute for Data, Intelligent Systems, and Computation.

Extensive up-to-date computer facilities are available on campus and in the department. High Performance Computing facilities (http://www.lehigh.edu/computing/hpc/), can be accessed directly from graduate student and faculty offices through a high speed backbone. Access to the Extreme Science and Engineering Discovery Environment (XSEDE) is available through computing time allocations to Lehigh faculty.

Courses

PHY 005 Concepts In Physics 4 Credits
Fundamental discoveries and concepts of physics and their relevance to current issues and modern technology. For students not intending to major in science or engineering. Lectures, demonstrations, group activities, and laboratories using modern instrumentation and computers. This is a non-calculus course; no previous background in physics is assumed. Three class meetings and one laboratory period per week.
Attribute/Distribution: NS, NW, Q

PHY 009 Introductory Physics I Completion 0-2 Credits
For students who have Advanced Placement or transfer credit for 2 or 3 credits of PHY 11. The student will be scheduled for the appropriate part of PHY 11 to complete the missing material. The subject matter and credit hours will be determined by the Physics Department for each student. Students with AP Physics C credit for mechanics will take the thermodynamics and kinetic theory part of PHY 11 for one credit. Consent of department required.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS, NW, Q

PHY 010 General Physics I 0,4 Credits
Statics, dynamics, conservation laws, thermodynamics, kinetic theory of gases, fluids. Primarily for architecture, biological science, earth and environmental science students.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS, NW, Q

PHY 011 Introductory Physics I 0,4 Credits
Kinematics, frames of reference, laws of motion in Newtonian theory and in special relativity, conservation laws, as applied to the mechanics of mass points; temperature, heat and the laws of thermodynamics; kinetic theory of gases. Two lectures and two recitations per week.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS, NW, Q

PHY 012 Introductory Physics Laboratory I 1 Credit
A laboratory course taken concurrently with PHY 10 or 11. Experiments in mechanics, heat, and DC electrical circuits. One three-hour laboratory period per week.
Prerequisites: PHY 010 or PHY 011
Can be taken Concurrently: PHY 010, PHY 011
Attribute/Distribution: LS, NS, NW

PHY 013 General Physics II 0,3 Credits
A continuation of PHY 10, primarily for biological science and earth and environmental science students. Electrostatics, electromagnetism, light, sound, atomic physics, nuclear physics, and radioactivity.
Prerequisites: (PHY 010 or PHY 011) and (MATH 021 or MATH 031 or MATH 051)
Can be taken Concurrently: MATH 021, MATH 031, MATH 051
Attribute/Distribution: NS, NW, Q

PHY 019 Introductory Physics II Completion 0-2 Credits
For students who have Advanced Placement or transfer credit for 2 or 3 credits of PHY 21. The student will be scheduled for the appropriate part of PHY 21 to complete the missing material. The subject matter and credit hours will be determined by the Physics Department for each student. Students with AP Physics C credit for electricity and magnetism will take the optics and modern physics part of PHY 21 for one credit. Consent of instructor required.
Prerequisites: (PHY 010 or PHY 011) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS, NW, Q

PHY 021 Introductory Physics II 0,4 Credits
A continuation of PHY 11. Electrostatics and magnetostatics; DC circuits; Maxwell's equations; waves; physical and geometrical optics; introduction to modern physics. Two lectures and two recitations per week.
Prerequisites: (PHY 010 or PHY 011) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS, NW, Q

PHY 022 Introductory Physics Laboratory II 1 Credit
A laboratory course to be taken concurrently with PHY 13 or 21. One three-hour laboratory period per week.
Prerequisites: (PHY 012) and (PHY 021 or PHY 013)
Can be taken Concurrently: PHY 021, PHY 013
Attribute/Distribution: LS, NS, NW

PHY 031 Introduction to Modern Physics 3 Credits
Experimental basis and historical development of special relativity and quantum mechanics; the Schroedinger equation; one-dimensional problems; angular momentum and the hydrogen atom; many-electron systems; spectra; selected applications.
Prerequisites: PHY 013 or PHY 021
Attribute/Distribution: NS, Q

PHY 091 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 120 Physics of Medical Imaging: Ultrasound and Radiography 3 Credits
An introduction and analysis of the physical principles and effects that underlay medical imaging techniques such as those using ultrasound, x-rays or other high-energy radiation. The course will serve as an introduction to intermediate quantum physics and electromagnetism concepts and discuss the effects and data collection techniques that ultimately allow to create an image that a physician can interpret for clinical purposes.
Prerequisites: PHY 021 or PHY 013
Attribute/Distribution: NS, W

PHY 122 Physics of Medical Imaging: Magnetic Resonance 3 Credits
An introduction and analysis of the physical principles and effects that underlay medical imaging techniques based on nuclear magnetic resonance, such as MRI (Magnetic Resonance Imaging). The course will serve as an introduction to intermediate/advanced quantum physics and electromagnetism concepts and discuss the effects and data collection techniques that ultimately allow to create an image that a physician can interpret for clinical purposes.
Prerequisites: PHY 021 or PHY 013
Attribute/Distribution: NS, W

PHY 142 Special Relativity 3 Credits
A development of the special theory of relativity at an introductory/intermediate level. Starting from the equivalence between inertial reference frames, the course will introduce the Lorentz transformations, space and time in different reference frames, the new relativistic versions of kinematics and mechanics, and the relationship between relativity and electromagnetism. Topics include momentum and energy, four-vectors, acceleration and forces, the relativistic version of Newton's second law, zero-mass particles, and the relation between electric and magnetic fields.
Prerequisites: PHY 013 or PHY 021
Attribute/Distribution: NS, Q

PHY 191 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 212 Electricity and Magnetism I 3 Credits
Electrostatics, magnetostatics, and electromagnetic induction.
Prerequisites: (PHY 021 or PHY 013) and MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS, Q

PHY 213 Electricity and Magnetism II 3 Credits
Maxwell's equations, Poynting's theorem, potentials, the wave equation, waves in vacuum and in materials, transmission and reflection at boundaries, guided waves, dispersion, electromagnetic field of moving charges, radiation, Lorentz invariance and other symmetries of Maxwell's equations.
Prerequisites: PHY 212
Attribute/Distribution: NS, Q, W

PHY 215 Classical Mechanics I 4 Credits
Kinematics and dynamics of point masses with various force laws; conservation laws; systems of particles; rotating coordinate systems; rigid body motions; topics from Lagrange's and Hamilton's formulations of mechanics; continuum mechanics.
Prerequisites: (PHY 021 or PHY 013) and MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS, Q

PHY 220 Advanced Physics Laboratory I 3 Credits
In a lab/lecture format, students learn basic elements needed for experimental, observational and computational work in physics, astrophysics and other technical areas. This course and its continuation as PHY 221 include topics such as electronics, optics, vacuum systems, data acquisition and analysis, curve fitting, scientific computing, interfacing of computers to experiments, and modern machining. These methods will be utilized in the examination of various physical systems; e.g., atomic and molecular spectroscopy, astronomical observations, condensed-matter phenomena, and others.
Prerequisites: PHY 021 and (PHY 022 or CSE 003 or CSE 007)
Attribute/Distribution: LS, NS, Q, W

PHY 221 Advanced Physics Laboratory II 2 Credits
This is a continuation of PHY 220.
Prerequisites: PHY 021 and PHY 022 and PHY 220
Attribute/Distribution: LS, NS, Q

PHY 273 Research 2-3 Credits
Participation in current research projects being carried out within the department.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, Q

PHY 291 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 300 Apprentice Teaching 1-4 Credits

PHY 332 (ASTR 332) High-Energy Astrophysics 3 Credits
Observation and theory of X-ray and gamma-ray sources, quasars, pulsars, radio galaxies, neutron stars, black holes. Results from ultraviolet, X-ray and gamma-ray satellites. Generally offered in the spring of odd-numbered years.
Prerequisites: (PHY 021) and (MATH 023 or MATH 033) and PHY 031 and PHY 215
Can be taken Concurrently: MATH 023, MATH 033
Attribute/Distribution: NS, Q

PHY 340 Thermal Physics 3 Credits
Basic principles of thermodynamics, kinetic theory, and statistical mechanics, with emphasis on applications to classical and quantum mechanical physical systems.
Prerequisites: (PHY 013 or PHY 021) and (MATH 023 or MATH 032 or MATH 052)
Attribute/Distribution: NS, Q

PHY 342 (ASTR 342) General Relativity 3 Credits
An introduction to Einstein's theory of general relativity. Topics covered: the geometry of spacetime; curvature and the gravitational field equations; the Schwarzschild and Kerr black holes and more general spacetime geometries; black hole thermodynamics; gravitational waves; the Friedmann–Robertson–Walker geometry and inflationary cosmology; dark energy and the cosmological constant problem.
Prerequisites: (PHY 021) and (MATH 023 or MATH 033) and PHY 215
Can be taken Concurrently: MATH 023, MATH 033, PHY 215
Attribute/Distribution: NS, Q

PHY 348 Plasma Physics 3 Credits
Single particle behavior in electric and magnetic fields, plasmas as fluids, waves in plasmas, transport properties, kinetic theory of plasmas, controlled thermonuclear fusion devices. Must have senior standing or consent of the department chair.
Prerequisites: PHY 021 and MATH 205
Attribute/Distribution: NS, Q

PHY 352 Modern Optics 3 Credits
Paraxial optics, wave and vectorial theory of light, coherence and interference, diffraction, crystal optics, and lasers.
Prerequisites: MATH 205 and (PHY 213 or ECE 203)
Can be taken Concurrently: PHY 213, ECE 203
Attribute/Distribution: NS

PHY 355 Nonlinear Optics 3 Credits
This course will introduce the fundamental principles of nonlinear optics. Topics include nonlinear interaction of optical radiation with matter, multi-photon interactions, electro-optics, self and cross phase modulation, and the nonlinear optical susceptibilities that describe all these effects in the mainframe of electromagnetic theory.
Prerequisites: PHY 031 and (PHY 213 or ECE 203)
Can be taken Concurrently: PHY 213, ECE 203
Attribute/Distribution: NS, Q

PHY 362 Quantum Mechanics I 3 Credits
Principles and basic applications of quantum mechanics. The Schrödinger equation and one-dimensional problems. Observables as operators; eigenfunctions and eigenvalues. Angular momentum, central potentials, the hydrogen atom, and spin. Addition of angular momentum. Exchange symmetry, Pauli principle, and multi-electron atoms. Selected applications to atoms and molecules, solids, quantum technologies, nuclei, and elementary particles.
Prerequisites: (PHY 031 or CHM 341) and MATH 205
Attribute/Distribution: NS, Q

PHY 363 Physics of Solids 3 Credits
Introduction to the theory of solids with particular reference to the physics of metals and semiconductors.
Prerequisites: (PHY 031 or MAT 316 or CHM 341) and PHY 340
Can be taken Concurrently: PHY 340
Attribute/Distribution: NS, Q

PHY 364 Nuclear and Elementary Particle Physics 3 Credits
Models, properties, and classification of nuclei and elementary particles; nuclear and elementary particle reactions and decays; radiation and particle detectors; accelerators; applications.
Prerequisites: PHY 031 and MATH 205 and PHY 362
Attribute/Distribution: NS, Q

PHY 365 Physics Of Fluids 3 Credits
Concepts of fluid dynamics; continuum and molecular approaches; waves, shocks and nozzle flows; nature of turbulence; experimental methods of study.
Prerequisites: (PHY 212 or ECE 202) and (PHY 340 or ME 104)
Can be taken Concurrently: PHY 212, ECE 202, PHY 340, ME 104
Attribute/Distribution: NS

PHY 366 Introduction to String Theory 3 Credits
Introduction to string theory for upper-level undergraduates and beginning graduate students. Building on Einstein's theory of general relativity and quantum theory, this course covers the fundamentals of string theory and the latest developments. Advanced topics such as D-branes, non-perturbative dualities and holography will also be covered. The course content is appropriate to students who have a working knowledge of quantum mechanics and special relativity, and have had some exposure to general relativity. Instructor permission required in lieu of Phy 362/369.
Prerequisites: PHY 031 and PHY 215 and (PHY 362 or PHY 369)
Can be taken Concurrently: PHY 369
Attribute/Distribution: NS, Q, W

PHY 369 Quantum Mechanics II 3 Credits
Applications of quantum mechanics to more complex problems. Bose and Fermi statistics of identical particles. Perturbation theory and applications to atomic structure. Variational method, WKB approximation, and scattering theory. Time-dependent perturbation theory and Fermi's golden rule. Selection of special topics.
Prerequisites: PHY 031 and MATH 205 and PHY 215 and PHY 362
Attribute/Distribution: NS, Q

PHY 380 Introduction to Computational Physics 3 Credits
Introduction to computational modeling of physical systems. Methods for systems of particles and fields with examples drawn from mechanics, chemical kinetics, planetary motion, chaotic dynamics, normal modes and waves, random walks, electrodynamics, biological, thermal and quantum systems. Converting models into well-documented code organized into manageable tasks. Extracting physical insight. Choice of numerical methods considering accuracy, speed, stability, and conservation laws.
Prerequisites: MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS, Q, W

PHY 382 Physics of Cells 3 Credits
This course focuses on the physical principles underlying the organization of living cells, which spans several orders of magnitude in length and time. It provides an introduction to biological physics and relevant concepts of soft-matter physics. Topics include: self-organization of filaments and motor proteins of the cytoskeleton that determine cell shape and motion; the plasma membrane as a fluid responsive to environmental and biochemical signals; biological waves and pattern formation; mathematical modeling of biological systems; experimental methods and image analysis.
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021)
Attribute/Distribution: NS, Q, W

PHY 389 Honors Project 1-8 Credits
Opportunity for Physics majors to pursue an Honors project with consent of department.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q

PHY 391 Special Topics In Physics 1-3 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 420 Mechanics 3 Credits
Includes the variational methods of classical mechanics, methods of Hamilton and Lagrange, canonical transformations, Hamilton-Jacobi Theory.

PHY 421 Electricity & Magnetism I 3 Credits
Electrostatics, magnetostatics, Maxwell's equations, dynamics of charged particles, multipole fields.

PHY 422 Electricity & Magnetism II 3 Credits
Electrodynamics, electromagnetic radiation, physical optics, electrodynamics in anisotropic media. Special theory of relativity.
Prerequisites: PHY 421

PHY 423 Quantum Mechanics I 3 Credits
The first course in a two-course sequence on quantum mechanics for graduate students. This course covers the fundamentals of quantum mechanics and quantum dynamics. Topics include matrix mechanics, wave mechanics, and the Dirac formulation; unitary time evolution in the Schrödinger and Heisenberg pictures; exactly solvable problems, such as the harmonic oscillator and the hydrogen atom; theory of angular momentum and addition of angular momentum; and time-independent approximation methods.

PHY 424 Quantum Mechanics II 3 Credits
The second course in a two-course sequence on quantum mechanics for graduate students. Topics include time-dependent approximation methods and the interaction picture, scattering theory, density matrices and entanglement, and a selection of advanced topics.
Prerequisites: PHY 423

PHY 425 Quantum Mechanics III 3 Credits
A continuation of Phys 424. Relativistic quantum theory of the electron; theory of radiation.
Prerequisites: PHY 424

PHY 428 Methods of Mathematical Physics I 3 Credits
Analytical and numerical methods of solving the ordinary and partial differential equations that occur in physics and engineering. Includes treatments of complex variables, special functions, product solutions and integral transforms.

PHY 431 Theory Of Solids 3 Credits
Advanced topics in the theory of the electronic structure of solids. Many-electron theory. Theory of transport phenomena. Magnetic properties, optical properties. Superconductivity. Point imperfections.
Prerequisites: PHY 363 and PHY 424

PHY 442 Statistical Mechanics 3 Credits
General principles of statistical mechanics with application to thermodynamics and the equilibrium properties of matter.
Prerequisites: PHY 340 and PHY 369

PHY 443 Nonequilibrium Statistical Mechanics 3 Credits
A continuation of PHY 442. Applications of kinetic theory and statistical mechanics to nonequilibrium processes; nonequilibrium thermodynamics.
Prerequisites: PHY 442

PHY 446 Atomic and Molecular Physics 3 Credits
Advanced topics in the experimental and theoretical study of atomic and molecular structure. Topics include fine and hyperfine structure, Zeeman effect, interaction of light with matter, multi-electron atoms, molecular spectroscopy, spectral line broadening atom-atom and electron-atom collisions and modern experimental techniques.
Prerequisites: PHY 424

PHY 455 Physics of Nonlinear Phenomena 3 Credits
Basic concepts, theoretical methods of analysis and experimental development in nonlinear phenomena and chaos. Topics include nonlinear dynamics, including period-multiplying routes to chaos and strange attractors, fractal geometry and devil's staircase. Examples of both dissipative and conservative systems will be drawn from fluid flows, plasmas, nonlinear optics, mechanics and waves in disordered media. Must have graduate standing in science or engineering, or consent of the chairman of the department.

PHY 462 Theories of Elementary Particle Interactions 3 Credits
Relativistic quantum theory with applications to the strong, electromagnetic and weak interactions of elementary particles.
Prerequisites: PHY 425

PHY 472 Special Topics In Physics 1-3 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.

PHY 474 Seminar In Modern Physics 3 Credits
Discussion of important advances in experimental physics.
Repeat Status: Course may be repeated.

PHY 475 Seminar In Modern Physics 3 Credits
Discussion of important advances in theoretical physics.
Repeat Status: Course may be repeated.

PHY 490 Thesis 1-6 Credits

PHY 491 Research 3 Credits
Research problems in experimental or theoretical physics.

PHY 492 Research 3 Credits
Continuation of PHY 491.
Repeat Status: Course may be repeated.

PHY 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Political Science

Brian L. Fife, Ph.D, Professor and Department Chair

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http://cas.lehigh.edu/pols (http://cas.lehigh.edu/pols/)

The major in political science is designed to promote understanding of political ideas, institutions and processes, and to develop skills in analyzing and evaluating political problems.

A balanced program within the discipline, one that exposes the student to various areas of inquiry in political institutions and political processes as well as in the comparative and philosophical perspectives of political analysis, has been the manner in which the goals of the major program generally have been achieved. While the major program outlined below will prove adequate for most student needs, it may be that some special factors such as late transfer or unusual interests and/or abilities the outlined program does not accommodate some students. In that case students may, in consultation with their advisers, develop a major program that in their judgment will more adequately fulfill those needs.

The faculty adviser to the student majoring in political science is designated by the department. The adviser consults with the student and approves the major program. The adviser attempts to help the student relate courses offered by the department to the student's educational goals. The adviser also may act as a resource for the student, and may suggest courses in other disciplines, language courses, and courses in research techniques that may be of benefit.

A variety of experiential opportunities are available to undergraduates majoring in political science. The department, for example, offers a Community Politics Internship every semester that includes opportunities for internship placements in either local government, private agencies, or law offices. Students are also encouraged to apply for off-campus internship opportunities, e.g., American University's Washington Semester Program and The Philadelphia Center's Internship in Philadelphia.

Completion of the political science major is considered suitable training for the undergraduate who wishes to go to law school, to become a social science teacher, or to work as a governmental official, party or civic leader, public affairs commentator, or staff member of a government research bureau. In addition, the private sector continues to provide opportunities in areas such as banking, insurance, and marketing for bachelor of arts graduates with training in the social sciences. Graduate study is advisable for students contemplating certain careers: college teaching, research, or public administration, for example.

The three core courses are required. Individual exceptions may be made, for good reasons, by the major adviser with the approval of the department chair.

PROGRAM REQUIREMENTS

Students that wish to major in political science will need to select an area of specialization that they will follow. The two categories to choose from are American Politics, Public Law, and Public Policy, and Political Theory and Comparative Politics.

American Politics, Public Law, and Public Policy Category

All political science majors must take the following three core courses:		
POLS 001	American Political System	4
POLS 003	Comparative Politics	4
POLS 100	Introduction to Political Thought	4
American Politics, Public Law, and Public Policy students must take one of the following three courses:		4
POLS 230	Social Movements From the 1960s to Present	
POLS 274	Political Parties and Elections	
POLS 358	Interest Groups, Power, and Democracy in American Politics	
American Politics, Public Law, and Public Policy students must also take one of the following political institution courses:		4
POLS 317	The American Presidency	
POLS 347	Constitutional Law and Politics	
POLS 359	U.S.Congress	
American Politics, Public Law, and Public Policy students must take any five additional political science courses, excluding 1and 2-credit courses.		20
Total Credits		**40**

Political Theory and Comparative Politics Category

All political science majors must take the following three core courses:		
POLS 001	American Political System	4
POLS 003	Comparative Politics	4
POLS 100	Introduction to Political Thought	4
Political Theory and Comparative Politics students must also take one of the following region specific courses:		4
POLS 201	South Asian Politics	
POLS 323	Politics Of The European Union	
POLS 339	The Rise of the State in Modern East Asia	
Political Theory and Comparative Politics students must also take one of the following social identity courses:		4
POLS 325	Nationalism, Regionalism, and Populism	
POLS 343	Global Politics of Race: Asia and Africa	
POLS 350	Religion and Politics in Comparative Perspective	
Political Theory and Comparative Politics students must also take one of the following theory courses:		4
POLS 356	Seminar: Political Philosophy	
POLS 357	Politics Of Authenticity	
Political Theory and Comparative Politics students must take any four additional political science courses, excluding 1and 2-credit courses.		16
Total Credits		**40**

POLITICAL SCIENCE MINOR

It takes **five (5) courses to complete the political science minor**. Two core courses are required plus any three other POLS courses (core or elective).

Political Science Minor

Select Two of the Following:		**8**
POLS 001	American Political System	
POLS 003	Comparative Politics	
POLS 100	Introduction to Political Thought	
Select any three other POLS courses (either "core" or elective options), excluding 1 or 2-credit courses.		12
Total Credits		**20**

PUBLIC ADMINISTRATION MINOR

The minor consists of:

The following courses are required:

POLS 001	American Political System	4
POLS 103	Introduction to Public Administration	4

Three additional courses chosen in consultation with the advisor.	12
Total Credits	**20**

ELECTIVE CATEGORIES

The following electives fall under the American Politics, Public Law, and Public Policy category.

AMERICAN POLITICS, PUBLIC LAW, AND PUBLIC POLICY	AMERICAN POLITICS, PUBLIC LAW, AND PUBLIC POLICY Not Found
POLS 103	Introduction to Public Administration
POLS 104	Political Sociology
POLS 105	US Environmental Policy and Law
POLS 107	The Politics of the Environment
POLS 109	Introduction to Public Policy
POLS 110	Environmental Planning for Healthy Cities
POLS 115	Technology As Politics
POLS 126	Religion, Law and Constitution
POLS 179	Politics of Women
POLS 202	Mock Trial
POLS 205	The Political Development of American Race Relations
POLS 210	Revolution on Campus
POLS 230	Social Movements From the 1960s to Present
POLS 232	War on Terror in Politics, Media, and Memory
POLS 240	Law and Order. The Politics of Crime and Punishment
POLS 274	Political Parties and Elections
POLS 302	Comparative State Politics
POLS 305	Residential Segregation: Policies and Practices
POLS 306	Public Policy Process
POLS 307	The Politics of Mental Health Policy
POLS 309	Nonprofit Administration
POLS 310	Social Entrepreneurship: How to Change the World
POLS 311	Environmental Valuation for Policy Design
POLS 312	Urban Environmental Policy Workshop
POLS 314	Urban Agriculture Policy, Planning and Practice
POLS 317	The American Presidency
POLS 319	Mapping Data for Policymaking
POLS 320	Food Justice in Urban Environments
POLS 326	Organizing For Democracy
POLS 328	U.S. Politics and the Environment
POLS 329	Propaganda, Media, and American Politics
POLS 331	Community Politics Internship
POLS 332	The Politics of Inequality
POLS 347	Constitutional Law and Politics
POLS 348	Land Use, Growth Management, and the Politics of Sprawl
POLS 349	Greed: Social Policy for Profit
POLS 352	Civil Rights and Civil Liberties
POLS 354	U.S. Health Care Politics
POLS 358	Interest Groups, Power, and Democracy in American Politics
POLS 359	U.S.Congress
POLS 360	Public Administration
POLS 363	Public Opinion Research
POLS 366	Advanced Environmental Policy
POLS 368	Political Economy
POLS 373	Globalization and Social Well-Being
POLS 376	Seminar: National Social Policy
POLS 380	The End of Policing? Politics of Social Control

The following electives fall under the Political Theory and Comparative Politics category.

POLITICAL THEORY AND COMPARATIVE POLITICS	POLITICAL THEORY AND COMPARATIVE POLITICS Not Found
POLS 101	Ancient Political Heritage
POLS 102	Modern Political Heritage
POLS 106	Environmental Values and Ethics
POLS 127	The Politics of Ending Global Poverty
POLS 201	South Asian Politics
POLS 321	Research Methods
POLS 322	The Politics of Data
POLS 323	Politics Of The European Union
POLS 324	Politics Of Western Europe
POLS 325	Nationalism, Regionalism, and Populism
POLS 335	Latin American Political Systems
POLS 336	U.S. Foreign Policy and Latin America
POLS 337	Religion and Politics in Latin America
POLS 339	The Rise of the State in Modern East Asia
POLS 340	Domination
POLS 342	Gender and Third World Development
POLS 343	Global Politics of Race: Asia and Africa
POLS 350	Religion and Politics in Comparative Perspective
POLS 355	Environmental Justice: From Theory to Practice
POLS 356	Seminar: Political Philosophy
POLS 357	Politics Of Authenticity
POLS 364	Issues In Contemporary Political Philosophy
POLS 367	American Political Thought
POLS 369	Women's Movement in China
POLS 370	Seminar: The Citizen versus the Administrative State

The following elective courses may fall under either category.

POLS 091	Special Topics
POLS 191	Special Topics
POLS 291	Special Topics
POLS 391	Special Topics
POLS 392	Independent Study
POLS 378	Honors Thesis In Political Science
POLS 379	Honors Thesis In Political Science

POLITICAL SCIENCE HONORS

Students must have at least a 3.2 cumulative grade point average, and a 3.3 major grade point average with senior standing , in order to proceed with departmental honors. Students with honors must complete ten courses in the major, including an independent study focusing on the honors thesis.

MASTER OF ARTS IN POLITICS AND POLICY

Political Science

For Graduate Students the department offers a graduate program leading to the Master of Arts degree. The applicant for admission is required to demonstrate adequate undergraduate preparation.

The Master of Arts in politics and policy is a 30 credit hour program that can be accomplished in 12 months by full-time students. Students interested in enrolling on a part-time basis will be given consideration, but the expectation is that most students will complete the program in a year. Students must take ten classes, which include three core courses and seven electives, all at the 400 level.

Three core courses are required:

POLS 400	Research in Politics and Public Policy	3
Select one of the following:		
POLS 456	Seminar: Political Philosophy	3
or POLS 457	Politics Of Authenticity	
Select one of the following:		
POLS 402	Methods Of Policy Analysis	3
or POLS 422	The Politics of Data	
Select any other seven POLS courses at the 400 level.		21
Total Credits		**30**

MASTER OF PUBLIC POLICY

POLITICAL SCIENCE

For Graduate Students the department offers a graduate program leading to the Master of Public Policy degree. The applicant for admission is required to demonstrate adequate undergraduate preparation.

The Master of Public Policy is a 30 credit hour program that can be accomplished in 12 months by full-time students. Students interested in enrolling on a part-time basis will be given consideration, but the expectation is that most students will complete the program in a year. Students must take ten classes (all at the 400-level). All students are required to take 5 core courses and 5 elective courses of their choice. With the approval of the department Director of Graduate Studies, students may take graduate-level courses outside of the Department of Political Science.

The following 5 core courses are required:

POLS 400	Research in Politics and Public Policy	3
POLS 402	Methods Of Policy Analysis	3
POLS 406	Public Policy Process	3
POLS 419	Mapping Data for Policymaking	3
POLS 460	Public Administration	3
Choose an additional five elective courses at the 400 level		15

COMMUNITY FELLOWS PROGRAM

Students interested in state or local public service or nonprofit work may also elect to apply to the Community Fellows program in which the student works for 15 hours per week for a local non-profit organization on a project related to community (re)development. For more information on the Community Fellows program, please see the program website www.lehigh.edu/communityfellows (http://www.lehigh.edu/communityfellows/).

Graduate students may choose to write a major paper (one semester) or a Master's thesis (two semesters) that will be defended before a panel of faculty members. Those participating in the Community Fellows program may be required to write a paper summarizing and analyzing their community fellows experience.

The Master of Arts program is intended for high-achieving students with a social science and liberal arts background who have a keen interest in the study of politics and/or are interested in the Community Fellows program and related experiential learning opportunities. The Master of Arts prepares students for further study in political science, public policy, or the law as well as careers in business, public service, or nonprofit organizations.

Courses

POLS 001 American Political System 4 Credits
Constitutional principles; organization and operation of the national government; and dynamics of power within the U.S. political system.
Attribute/Distribution: CC, SS, SW

POLS 003 (GS 003) Comparative Politics 4 Credits
The political systems of foreign countries; approaches to the study of comparative politics.
Attribute/Distribution: CC, SS, SW

POLS 091 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, SS, SW, W

POLS 100 (GS 100, PHIL 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

POLS 101 Ancient Political Heritage 4 Credits
Important political thinkers from the pre-Socratics to early, modern political theorists like Machiavelli.
Attribute/Distribution: SS

POLS 102 Modern Political Heritage 4 Credits
Begins where POLS 101 ends: from early, modern theorists (e.g., Hobbes) up to contemporary thinkers (e.g., Marcuse).
Attribute/Distribution: SS

POLS 103 Introduction to Public Administration 4 Credits
This course presents the intellectual history of the study of public administration in a manner that is intended to inform career choices for those who might consider public service and provide a broad introduction to the field of public administration. Students will gain a comprehensive perspective on the public administration discipline by exploring the pervasive puzzles, ethical dilemmas, and the critical issues in governance to date.
Attribute/Distribution: SS

POLS 104 (SOC 104) Political Sociology 4 Credits
An introduction to political sociology through an examination of the major sociological questions concerning power, politics, and the state. Covers questions concerning state formation, nationalism, social movements, globalization, political culture and participation, and civil society.
Attribute/Distribution: CC, SS, SW

POLS 105 (EVST 105) US Environmental Policy and Law 4 Credits
Analysis of the framework that has been established to protect the environment and promote sustainable growth. Focus on the roles of the different branches of the U.S. government and the relative responsibilities of state and local governments within this framework. Consideration of the political nature of environmental issues and the social forces influencing environmental protection in different areas of domestic environmental policy, such as climate change, toxic waste disposal, and natural resources conservation.
Attribute/Distribution: CC, SS, SW, W

POLS 106 (EVST 106) Environmental Values and Ethics 4 Credits
An introduction to the ethical perspectives and values that shape human relationships to the natural environment in contemporary society. What are the moral implications of these relationships for justice and human collective action? Given these implications, what policy responses to environmental problems are morally or politically justifiable? In answering these questions, the course explores ethical ideas developed in different schools of environmental thought, such as deep ecology and ecofeminism, in addition to ideas that emerge from social movements, such as.
Attribute/Distribution: CC, HE, SS, W

POLS 107 (EVST 107) The Politics of the Environment 4 Credits
A survey of the major environmental, resource, energy and population problems of modern society, focusing on the United States. The politics of man's relationship with nature, the political problems of ecological scarcity and public goods, and the response of the American political system to environmental issues.
Attribute/Distribution: CC, SS, SW

POLS 109 Introduction to Public Policy 4 Credits
Introduces students to the basic theories, principles, institutions, and processes of public policy in the U.S. The objectives are to provide students with an understanding of how social problems are defined, how potential solutions to those problems move through the policy process, and gain an empirical perspective on the consequences, as well as insight regarding the normative dimensions of policy making. Students will develop knowledge of the framework for understanding policy and engage in critical thinking regarding the nature of.
Attribute/Distribution: SS, SW

POLS 110 (ES 110, EVST 110, HMS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of "sustainability;" and grapple with the challenge of balancing communities' demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: CC, SS, SW

POLS 115 Technology As Politics 4 Credits
Relationship of technology and technological change with politics and public policy. Review of theories of political significance of technology, including technological determinism, technology assessment, technological progress and appropriate technology. Specific issues in technology with emphasis on U.S.
Attribute/Distribution: SS, SW

POLS 126 (REL 126) Religion, Law and Constitution 4 Credits
An examination of the relationship of religion to American law and the United States Constitution. Course will focus on Supreme Court decisions involving the "establishment" and "free exercise" clauses of the First Amendment. Attention will also be given to the intellectual, historical, religious and theological background behind the American experiment in "church-state" separation, including the thought of Roger Williams, the Founders (Washington, Jefferson, Madison), and contemporary analysts (e.g., M. Nussbaum).
Attribute/Distribution: CC, HU, SW

POLS 127 (GS 127) The Politics of Ending Global Poverty 4 Credits
Theories of poverty reduction meet the messy realities of social life around the world. Students in the course will understand why poverty persists and what kinds of solutions to it may be effective.
Attribute/Distribution: SS, SW

POLS 179 (WGSS 179) Politics of Women 4 Credits
Selected social and political issues relating to the role of women in American society. Focuses on such questions as economic equality, poverty, and work roles, the older woman, gender gap, political leadership, reproduction technology, and sexual violence.
Attribute/Distribution: SS

POLS 191 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, SS, SW, W

POLS 201 (ASIA 201, GS 201) South Asian Politics 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest.
Attribute/Distribution: CC, SS, SW

POLS 202 Mock Trial 1 Credit
This class interacts closely with Lehigh Mock Trial. Students will begin the year by learning the structure of a typical trial, rules of evidence and methods of persuasive argumentation. As the course develops, students will work to craft a case based on evidence, depositions, and case materials provided by AMTA (The American Mock Trial Association). At the conclusion of the semester, students will, optionally, compete with Lehigh Mock Trial at local tournaments and, eventually, the AMTA regional tournaments.

POLS 205 (AAS 205) The Political Development of American Race Relations 4 Credits
This course examines the distinctive role race has played in shaping the political history of the United States.
Attribute/Distribution: SS

POLS 210 (AAS 210, WGSS 210) Revolution on Campus 4 Credits
Universities are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.
Attribute/Distribution: CC, SS, SW

POLS 225 (IR 225) International Political Economy 4 Credits
Principles governing the interaction between the economic and political components of international phenomena. Political aspects of trade, investment, and global economic order. Political underpinnings of international economic relations. Domestic and international political consequences of economic policy and international economic relations.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: CC, SS

POLS 230 (AAS 230) Social Movements From the 1960s to Present 4 Credits
The lessons of U.S. social and political movements from the 1960s and the post-2000 era. Students examine social movements through the lens of intersectionality, with a focus on civil rights, anti-war activism, women's rights, global justice, and ecology movements, to assess their connection to democracy and citizens' lives.
Attribute/Distribution: CC, SS, SW

POLS 232 War on Terror in Politics, Media, and Memory 4 Credits
Examines the meaning of the US war on terrorism as interpreted and disputed in American politics, the mass media, and private and public memory. Reviews the political history and context of the war, personal experiences and critical perspectives on the war, and characterizations of the war in mainstream news media and popular film.
Attribute/Distribution: CC, SS, SW

POLS 240 Law and Order. The Politics of Crime and Punishment 4 Credits
This course explores the legal and political consequences of various theories of crime, punishment and social control in the United States. Topics include policing, racial profiling, trial court proceedings and the administration of justice, growing incarceration rates and the prison industry, capital punishment, the jury system, and the nature of legal obligation.
Attribute/Distribution: SS

POLS 274 Political Parties and Elections 4 Credits
Study of the organization, functions and behavior of political parties in the United States. Includes voting behavior, campaigns and elections, polling, interest groups, public opinion and the role of the media.
Attribute/Distribution: SS, SW

POLS 291 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, W

POLS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

POLS 302 Comparative State Politics 4 Credits
Analysis of major questions relating to the role of the states in the American federal system and their relationship with the national government.
Attribute/Distribution: SS, SW

POLS 305 (AAS 305, EVST 305) Residential Segregation: Policies and Practices 4 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.
Attribute/Distribution: CC, SS, SW

POLS 306 Public Policy Process 3-4 Credits
Power relations and their impacts on selected public policy issues, specifically taxation, housing, environment, poverty, energy, the military, and health.
Attribute/Distribution: SS

POLS 307 (HMS 307) The Politics of Mental Health Policy 4 Credits
What is normal behavior, and how do we come to understand mental illness? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

POLS 309 (ENTP 309) Nonprofit Administration 4 Credits
This course will address key questions in nonprofit sector research, policy, and management and familiarize students with factors that tend to make the nonprofit sector distinct. Students will gain an understanding of the scope and character of nonprofit activity in the U.S. and abroad. We will explore current debates in nonprofit policy and evaluate critical challenges facing the organization and management of nonprofits.
Attribute/Distribution: SS

POLS 310 (ENTP 310) Social Entrepreneurship: How to Change the World 4 Credits
The marketplace does not always have to be harsh. Social entrepreneurship uses market-based approaches to address needs and solve problems in our society. Students in this seminar-style course will learn how to identify community problems, convince the community that it is a problem worth solving, design the response, and implement it. Hands-on projects. Must have at least junior standing or consent of the minor director.
Attribute/Distribution: SS

POLS 311 (EVST 311) Environmental Valuation for Policy Design 4 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.
Attribute/Distribution: SS

POLS 312 (EVST 312) Urban Environmental Policy Workshop 4 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.
Attribute/Distribution: CC, SS, SW, W

POLS 314 Urban Agriculture Policy, Planning and Practice 4 Credits
Review of urban agriculture and greening programs in growing social movement to strengthen neighborhoods, promote healthier living, and create localized and sustainable food economies. Students consider these programs in relation to national farm policy and develop urban agriculture projects with community partners. Case studies illustrate how improving food access, beautifying vacant land, and reducing farm-to-table distances, are creatively and successfully combined. Students will receive hands-on gardening and farming experience at a community garden.
Attribute/Distribution: SS

POLS 317 The American Presidency 3-4 Credits
Role of the executive in the American political process. Includes an analysis of the historical development, selection process, and scope of executive power. Emphasizes domestic and foreign policy initiatives of selected presidents from FDR to today.
Prerequisites: (POLS 001)
Attribute/Distribution: SS, SW, W

POLS 319 (EVST 319) Mapping Data for Policymaking 4 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers' attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).
Attribute/Distribution: Q, SS

POLS 320 (EVST 320, HMS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.
Attribute/Distribution: CC, SS

POLS 321 Research Methods 4 Credits
Models in the explanation of political phenomena, appropriateness of measurement techniques; construction of research designs; rationale and application of statistical analyses; individual projects involving the construction and testing of models employing a major social science data set. Instructor permission required.
Attribute/Distribution: SS

POLS 322 The Politics of Data 4 Credits
Rapid advances in methods of data collection and analysis raise new political questions about how public institutions, the private sector, and individuals produce, use, and share data. This course examines how the emergence of data-driven decision-making is reshaping politics, exploring issues of inclusiveness, equality, privacy, and democratic accountability. We pay particular attention to how new methods of data analysis contribute to the exercise of power. If algorithms are not "neutral," then who is privileged in their use, diffusion and management?
Prerequisites: (POLS 003)
Attribute/Distribution: SS

POLS 323 Politics Of The European Union 4 Credits
The EU has experienced unprecedented challenges to its stability and legitimacy in recent years, with calls to enhance its democratic qualities and its potential for social, economic and environmental justice. This course covers the history, institutions, and policy-making processes of the European Union, with special attention to how the EU responds to and is shaped by policy crises. Recent topics have included immigration, the euro crisis, Brexit, EU trade policy, and the rise of populism in EU countries.
Prerequisites: POLS 003 or IR 010
Attribute/Distribution: CC, SS

POLS 324 Politics Of Western Europe 3,4 Credits
Comparative discussion of systems of government in Western Europe and of major policy questions facing these states in the post-war era. Topics include the evolution of social welfare systems, the impact of economic crises and globalization on Western European political economy, and immigration and identity politics.
Prerequisites: POLS 003
Attribute/Distribution: CC, SS

POLS 325 (GS 325) Nationalism, Regionalism, and Populism 3,4 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.
Prerequisites: POLS 003
Attribute/Distribution: CC

POLS 326 Organizing For Democracy 3-4 Credits
Seminar on the theory and practice of community and political organizing and their relationship with democracy and power in the United States, complementing semester-long student field placements with community groups and local organizations. Student teams help enhance the political voice of under-resourced community groups through organization-building, outreach, and policy input at the local level. Consent of instructor required.
Attribute/Distribution: SS

POLS 328 (EVST 328) U.S. Politics and the Environment 4 Credits
An examination of contemporary American politics and policy dealing with environmental issues. Current controversies in the legislative and regulatory areas will be covered to examine environmental issues and the political process. Significant portions of the course readings will be taken from government publications.
Attribute/Distribution: SS

POLS 329 Propaganda, Media, and American Politics 4 Credits
The role of propaganda and mass media in sustaining hegemony in the United States. Emphasis on television, advertising and mass culture, public relations, news media, and political propaganda pertaining to U.S. foreign and domestic policy. Students compare critical counter-hegemonic theories to political speeches, documents, news reports, and media encounters that shape much of American political life.
Attribute/Distribution: SS

POLS 331 Community Politics Internship 4 Credits
Integrated fieldwork and academic study. Seminar, research paper, and journal; internship with government and social service agencies, political groups, elected officials, and law offices. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC

POLS 332 (SOC 332) The Politics of Inequality 4 Credits
Examines the politics of gender, racial, and economic inequality in the U.S. Explores the effects of growing inequality on political representation, and the impact of government policy on perpetuating inequality. Class consciousness, and its effects on political beliefs and behavior, are examined.
Attribute/Distribution: CC, SS, SW

POLS 334 Quantitative Applications in Political Science 4 Credits
This course will cover applications of statistical reasoning and quantitative research design in political science and public policy research. Analysis will be performed in the programming language R, with an emphasis on learning tools for reproducible research. Prior coursework in computer programming and/or statistics is expected. Enrollment is by instructor permission.
Attribute/Distribution: Q

POLS 335 Latin American Political Systems 4 Credits
Democratic, authoritarian and revolutionary paths to contemporary political issues. Political, economic and social implications of contemporary “democratic” regimes and neo-liberal economic policies. Discussion groups and student presentations on prospects for democratic peace and prosperity in the future.
Prerequisites: (POLS 003)
Attribute/Distribution: SS

POLS 336 U.S. Foreign Policy and Latin America 3-4 Credits
U.S. historical relationship with Central America, Caribbean and South America with emphasis on economic and military dominance. Contemporary issues such as U.S. invasions of Panama and Grenada, U.S. Cuban relations, the militarization of the “drug war,” counter-insurgency. Written analysis of competing U.S. interests across time and regions.
Prerequisites: (POLS 003)
Attribute/Distribution: SS

POLS 337 Religion and Politics in Latin America 4 Credits
Indigenous and “imported” religious structures, the prominent role of the Catholic Church in Latin America, and the recent explosion of Protestant/ Pentecostal churches. Emphasis on the intersection of religious belief and power (i.e., gender, local politics, national development, etc.). Short papers integrate material with students’ knowledge of religious/political phenomena. Discussion groups analyze philosophical foundations of belief.
Prerequisites: (POLS 003 and POLS 336)
Attribute/Distribution: SS

POLS 339 (ASIA 339) The Rise of the State in Modern East Asia 4 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.
Attribute/Distribution: SS

POLS 340 Domination 4 Credits
Is hierarchy in human societies inevitable? How do we make sense of justice and equality if domination is an inescapable aspect of the social world? Our consideration of these questions will draw on a wide range of literatures including primatology, political philosophy, anthropology, and gender studies. We will also use non-academic sources such as films and novels to explore the world of domination and resistance.
Attribute/Distribution: SS

POLS 342 (GS 342, WGSS 342) Gender and Third World Development 3-4 Credits
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect 'real people?' How do economic theories affect men vs. women? What is the role of people who want to 'help?' Some background in economic theories and/or Third World politics desired, but not required.
Prerequisites: POLS 001 or WGSS 001
Attribute/Distribution: SS

POLS 343 (AAS 343, ASIA 343, GS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of "race" and its impact on domestic and international politics.
Attribute/Distribution: SS

POLS 347 Constitutional Law and Politics 4 Credits
Exploration of the process of legal reasoning, the place of the United States Supreme Court in the American political system, the multiple influences on judicial decision-making, and various interpretive debates over the meaning of the U.S. Constitution. Following this introduction to the interplay of law and politics, the focus turns to particular domains within the canon of constitutional law, including cases pertaining to the Supreme Court's jurisdiction and capacity; the separation of powers between the three branches of government; federalism.
Attribute/Distribution: SS

POLS 348 Land Use, Growth Management, and the Politics of Sprawl 3-4 Credits
An intro to the issues of Land Use Planning, Community, Growth Mgmt, & Sprawl. Will examine the history of urban development in America, from the earliest settlements to the auto suburbs. Also explore such planning & development factors as comprehensive plans, zoning, & the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, & comparisons to development patterns in other countries.
Attribute/Distribution: SS

POLS 349 (WGSS 349) Greed: Social Policy for Profit 4 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity strucures.

POLS 350 Religion and Politics in Comparative Perspective 4 Credits
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.
Attribute/Distribution: CC, SS, W

POLS 352 Civil Rights and Civil Liberties 4 Credits
A continuation of themes, issues, and debates of the previous semester (Constitutional Law and Politics). This course addresses the major cases and controversies within several legal domains, including the freedoms of and from religion; freedom of speech; freedom of association; freedom of the press; the right to bear arms; the rights of criminal defendants and suspects; the right to privacy; capital punishment; and, the equal protection of the law.
Attribute/Distribution: SS

POLS 354 (HMS 354) U.S. Health Care Politics 4 Credits
Health care programs, policies, and their impact on American society. Topics include approaches to health care; public sector plans (Medicare and Medicaid); managed care; the employer-sponsored system; medically uninsured; vested interests and lobbyists; movements for national health care; and options for change.
Attribute/Distribution: CC, SS

POLS 355 (EVST 355) Environmental Justice: From Theory to Practice 4 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administration policies, especially at the federal level. Considering the role of politics in the ongoing struggle for environmental justice, it reviews theories of substantive and procedural justice, and uses them to consider strategies for advancing equity in environmental law and policy.
Prerequisites: POLS 105 or ES 105
Attribute/Distribution: CC, SS

POLS 356 Seminar: Political Philosophy 3-4 Credits
Critical examination of several of the "great books" and/or "great ideas" in political thought. Students will help select the material for critical discussion.
Attribute/Distribution: SS

POLS 357 Politics Of Authenticity 4 Credits
Works in political philosophy, psychoanalytic theory, literature, and film that discuss knowing and being one's self will be critically discussed. If you feel a life of "quiet desperation" is inevitable, this course is for you.
Attribute/Distribution: SS

POLS 358 Interest Groups, Power, and Democracy in American Politics 4 Credits
Examines the competition for power in American politics between business groups, professional organizations, citizens groups, and social movements. Evaluates claims about the rise of upper-class dominance in politics, and what implications this trend may have for American democracy in an era of rising economic inequality.
Attribute/Distribution: SS

POLS 359 U.S.Congress 3-4 Credits
Elections for the House and Senate and their significance for the way in which Congress functions. The formal structure of party leadership and committees, House and Senate organizational and functional differences, and informal and formal power of legislation and oversight. Congressional relations with the president, bureaucracy, and Supreme Court.
Prerequisites: POLS 001
Attribute/Distribution: SS

POLS 360 Public Administration 3-4 Credits
The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary system; forms of administrative responsibility.
Attribute/Distribution: SS, WRIT

POLS 363 Public Opinion Research 4 Credits
This course examines fundamental processes and tools employed in public opinion research. This class is designed to provide students with the ability to develop, implement and evaluate various forms of public opinion research including surveys, focus groups and individual interviews.Students will be introduced to numerous aspects of public opinion research including questionnaire design, sampling, interviewing, data analysis, focus group moderation, and varied forms of data collection.
Attribute/Distribution: SS

POLS 364 (PHIL 364) Issues In Contemporary Political Philosophy 3-4 Credits
Selected topics in contemporary political philosophy, such as the Frankfurt school, existentialism, legitimation, authenticity, participatory democracy, and the alleged decline of political philosophy. May be repeated for credit with the consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

POLS 366 (EVST 366) Advanced Environmental Policy 4 Credits
An introduction to the history of domestic environmental policy and contemporary policy trends, such as the rise of legal adversarialism and public participation in regulatory decisions. The role of market instruments in policy implementation, the emergence of rights-based approaches to environmental protection, and the role and value of distributional analysis will also be covered. Students will develop knowledge of a particular area of environmental policy at the federal, state, and/or level depending on their interests and current opportunities.
Prerequisites: POLS 105 or ES 105
Attribute/Distribution: CC, SS

POLS 367 (PHIL 367) American Political Thought 3-4 Credits
A critical examination of American political thought from the founding of the Republic to the present. Writings from Madison, Hamilton, and Jefferson to Emma Goldman, Mary Daly, Malcolm X, Henry Kariel, and others will be discussed.
Attribute/Distribution: SS

POLS 368 Political Economy 3-4 Credits
Relationship of democratic politics to government and market, and significance of economic power in the American polity. Economic rationale for the place of the market and economic institutions in polity. Emphasis on information in comparison of economic approaches to public policy and organization (public goods, market failure, and collective action) with traditional political science approaches (group mobilization and conflict, non-decisions and symbolic action).
Attribute/Distribution: SS

POLS 369 (ASIA 369, GS 369, WGSS 369) Women's Movement in China 4 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, “did the Party liberate women?”
Attribute/Distribution: SS

POLS 370 Seminar: The Citizen versus the Administrative State 4 Credits
Administrative power and policy. Constitutional and judicial control of administration. Remedies against improper administrative acts. Major emphasis will be on the United States, with some attention given to analogous issues in other countries.
Attribute/Distribution: SS

POLS 373 Globalization and Social Well-Being 4 Credits
This course examines how the various dimensions of globalization impact people by exploring factors that reflect and affect quality of life. Students will gain an understanding of the complexities resulting from the growing interconnectedness and interdependencies of global relations. The course is intended to get people thinking creatively about opportunities for connections that preserve human dignity.
Attribute/Distribution: SS

POLS 376 Seminar: National Social Policy 3-4 Credits
A readings/research seminar on current social policy questions. analyzes, from alternatives political perspectives, such issues as Social Security, Medicare, health care, welfare reform, income inequality, and taxation. Students research a specific social issue of their choice. Class discussion on individual research and common readings.
Attribute/Distribution: SS

POLS 378 Honors Thesis In Political Science 1-4 Credits
Opportunity for undergraduate majors in Political Science to pursue an extended project for senior honors. Department permission required.
Attribute/Distribution: SS, W

POLS 379 Honors Thesis In Political Science 1-4 Credits
Continuation of POLS 378. Consent of department required.
Prerequisites: POLS 378
Attribute/Distribution: SS, W

POLS 380 (HMS 380, WGSS 380) The End of Policing? Politics of Social Control 4 Credits
"What are your prime directives? Serve the public trust, protect the innocent, uphold the law" (Robocop 1987). This course focuses on policy design and feedback and is not a course on police procedure or policing tactics. The primary objective of the course is to learn to think critically about public safety and evaluate policies based on their value to democracy.
Attribute/Distribution: CC

POLS 381 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

POLS 391 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, W

POLS 392 Independent Study 1-4 Credits
Individually supervised course in Political Science. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

POLS 400 Research in Politics and Public Policy 3 Credits
Provides students from a diverse array of academic backgrounds with an introduction to politics and public policy. Research topics will vary by instructor, with a primary emphasis on research in American politics, comparative politics, and public policy.

POLS 402 Methods Of Policy Analysis 3 Credits
Approaches or models used to analyze public policy. Assumptions underlying each model and critiques of each; may include a number of the following approaches: institutional, process, rational, group, incremental, and/or elite.

POLS 403 Creativity, Ideas, and Methods in Political Science 3 Credits
Explores the challenges and creative possibilities of turning ‘research interests’ into doable research projects – such as research papers, MA theses, or doctoral dissertations. Discusses the domains of qualitative methodology and how social scientists seek to understand, represent, and analyze the social world. Topics: the politics of interpretation, observation, and quantification in social research, and critiques of assumptions about power and causality.

POLS 405 (EVST 405) Residential Segregation: Policies and Practices 3 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

POLS 406 Public Policy Process 3 Credits
Power relations and their impacts on selected public policy issues, specifically taxation, housing, environment, poverty, energy, the military, and health.

POLS 407 The Politics of Mental Health Policy 3 Credits
What is normal behavior, and how do we come to understand mental illness? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

POLS 408 American Politics Core 3 Credits
A survey of American politics utilizing readings reflecting a variety of methodological approaches and theoretical perspectives. Readings include but are not limited to works widely regarded as “classics” in American political science.

POLS 409 Nonprofit Administration 3 Credits
This course will address key questions in nonprofit sector research, policy, and management and familiarize students with factors that tend to make the nonprofit sector distinct. Students will gain an understanding of the scope and character of nonprofit activity in the U.S. and abroad. We will explore current debates in nonprofit policy and evaluate critical challenges facing the organization and management of nonprofits.

POLS 411 (EVST 411) Environmental Valuation for Policy Design 3 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.

POLS 412 (EVST 412) Urban Environmental Policy Workshop 3 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

POLS 413 Modern Political Philosophy 3 Credits
A study of selected modern political philosophers and their continuing effect on politics and political philosophy.

POLS 415 State and Local Government 3 Credits
Comparative state government, urban politics, intergovernmental relations, regional and local government.

POLS 416 American Environmental Policy 3 Credits
Formation, implementation and impact of environmental policies in the U.S. An examination of the scope of environmental problems, the development of environment as an issue, the role of interest groups and public opinion, the policy-making process, and the various approaches to implementing environmental policy. Special attention to current issues and administrative approaches and to the distinctive character of environmental protection as a political issue.

POLS 419 (EVST 419) Mapping Data for Policymaking 3 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers' attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

POLS 420 (EVST 420) Food Justice in Urban Environments 3 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.

POLS 421 Research Methods 3 Credits
Models in the explanation of political phenomena, appropriateness of measurement techniques; construction of research designs; rationale and application of statistical analyses; individual projects involving the construction and testing of models employing a major social science data set.

POLS 422 The Politics of Data 3 Credits
Rapid advances in methods of data collection and analysis raise new political questions about how public institutions, the private sector, and individuals produce, use, and share data. This course examines how the emergence of data-driven decision-making is reshaping politics, exploring issues of inclusiveness, equality, privacy, and democratic accountability. We pay particular attention to how new methods of data analysis contribute to the exercise of power. If algorithms are not "neutral," then who is privileged in their use, diffusion and management?

POLS 423 Politics Of The European Union 3 Credits
The EU has experienced unprecedented challenges to its stability and legitimacy in recent years, with calls to enhance its democratic qualities and its potential for social, economic and environmental justice. This course covers the history, institutions, and policy-making processes of the European Union, with special attention to how the EU responds to and is shaped by policy crises. Recent topics have included immigration, the euro crisis, Brexit, EU trade policy, and the rise of populism in EU countries.

POLS 425 Nationalism,Regionalism, and Populism 3 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.

POLS 426 Organizing For Democracy 3 Credits
Seminar on the theory and practice of community and political organizing and their relationship with democracy and power in the United States, complementing semester-long student field placements with community groups and local organizations. Student teams help enhance the political voice of under-resourced community groups through organization-building, outreach, and policy input at the local level. Consent of instructor required.

POLS 427 American Democracy: Decline or Revival? 3 Credits
Theories of democracy, analysis of its decline, and possible scenarios for a revived democratic culture. Research projects on topics of personal interest; class participation in hands-on project in local democracy-building.

POLS 428 Media & Democracy 3 Credits
General & theoretical considerations about democracy, the political economy of the mass media, and analysis of ways in which the media influence political discourse in the United States and globalized media culture. Hands-on analysis of media samples: news coverage, political advertising, public relations advertising, and interactive learning on how group might utilize the media to express its voice effectively.

POLS 429 Propaganda, Media & American Politics 3 Credits
The role of propaganda and mass media in sustaining hegemony in the United States. Emphasis on television, advertising and mass culture, public relations, news media, and political propaganda pertaining to U.S. foreign and domestic policy. Students compare critical, counter-hegemonic theories to political speeches, documents, news reports, and media encounters that shape much of American political life.

POLS 430 Social Movements From the 1960s to Present 3 Credits
The lessons of U.S. social and political movements from the 1960s and the post 2000 era. Students examine social movements through the lens of intersectionality with a focus on civil rights, anti-war activism, women's rights, global justice, and ecology movements, to assess their connection to democracy, citizens' lives.

POLS 432 The Politics of Inequality 3 Credits
Examines the politics of gender, racial, and economic inequality in the U.S. Explores the effects of growing inequality on political representation, and the impact of government policy on perpetuating inequality. Class consciousness, and its effects on political beliefs and behavior, are examined.

POLS 433 The Politics Of Health Care 3 Credits
Examines the politics of American health care and its impact on society. Issues ranging from the role of the private sector to government-supported programs; focus on ways to restructure the system, based on alternatives in selected nations.

POLS 434 Quantitative Applications in Political Science 3 Credits
This course will cover statistical reasoning and quantitative research design at the graduate level. Analysis will be performed in the programming language R, with an emphasis on learning tools for reproducible research. No programming experience is required. This course is an approved elective for the MPP and MA in Political Science.

POLS 435 Power, Persuasion and the American Presidency 3 Credits
Examination of selected modern presidents, from FDR to the current occupant of the White House, and their effectiveness as communicators and policy makers.

POLS 439 The Rise of the State in Modern East Asia 3 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.

POLS 440 Domination 3 Credits
Is hierarchy in human societies inevitable? How do we make sense of justice and equality if domination is an inescapable aspect of the social world? Our consideration of these questions will draw on a wide range of literatures including primatology, political philosophy, anthropology, and gender studies. We will also use non-academic sources such as films and novels to explore the world of domination and resistance.

POLS 443 Global Politics of Race: Asia and Africa 3 Credits
An examination of the concept of “race” and its impact on domestic and international politics.

POLS 447 Constitutional Law and Politics 3 Credits
Exploration of the process of legal reasoning, the place of the United States Supreme Court in the American political System, the multiple influences on judicial decision-making, and various interpretive debates over the meaning of the U.S. Constitution. Following this introduction to the interplay of law and politics, the focus turns to particular domains within the canon of constitutional law, including cases pertaining to the Supreme Court's jurisdiction and capacity; the separation of powers between the three branches of government; federalism.

POLS 448 (HIST 448) Land Use, Growth Management, and the Politics of Sprawl 3 Credits
An intro to the issues of Land Use Planning, Community, Growth Mgmt, & Sprawl. Will examine the history of urban development in America, from the earliest settlements to the auto suburbs. Also explore such planning & development factors as comprehensive plans, zoning, & the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, & comparisons to development patterns in other countries.

POLS 449 (WGSS 449) Greed: Social Policy for Profit 3 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity strucures.

POLS 450 Religion and Politics in Comparative Perspective 3 Credits
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.

POLS 451 Comparative Politics Core 3 Credits
Discussion of major recent works in comparative politics that exemplify on-going substantive debates and methodological problems in the field. Topics: state-building and the construction of social order, institutions, political economy, democracy, development, and political mobilization.

POLS 452 Civil Rights and Civil Liberties 3 Credits
A continuation of themes, issues, and debates of the previous semester (Constitutional Law and Politics). This course addresses the major cases and controversies within several legal domains, including the freedoms of and from religion; freedom of speech; freedom of association; freedom of the press; the right to bear arms; the rights of criminal defendants and suspects; the right to privacy; capital punishment; and, the equal protection of the law.

POLS 453 Seminar: Media, Propaganda and Democracy 3 Credits
Research seminar on theoretical and applied issues related to democracy vs. political hegemony, as affected by propaganda, the mass media, popular culture, and the capitalist economy. Students will pursue individual research topics linked to common class readings. Weekly paper presentations and critical responses.

POLS 454 The State in Asia 3 Credits
Examination of state-directed political, economic and social development in and among Asian states, with an addition focus on the relationships between the domestic policies of various Asian states and relations with non-Asian states.

POLS 455 (EVST 455) Environmental Justice: From Theory to Practice 3 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administrative rule making at state and federal level. Reviewing the history of case law concerning environmental justice suits filed under the 1964 Civil Rights Act, it also examines the future of environmental justice in environmental law and policy.

POLS 456 Seminar: Political Philosophy 3 Credits
Critical examination of several of the “great books” and/or “great ideas” in political thought.

POLS 457 Politics Of Authenticity 3 Credits
Works in political philosophy, psychoanalytic theory, literature, and film that discuss knowing and being one’s self will be critically discussed. If you feel a life of “quiet desperation” is inevitable, this course is for you.

POLS 458 Interest Groups, Power, and Democracy in American Politics 3 Credits
Examines the competition for power in American politics between business groups, professional organizations, citizens groups, and social movements. Evaluates claims about the rise of upper-class dominance in politics, and what implications this trend may have for American democracy in an era of rising economic inequality.

POLS 460 (EVST 460) Public Administration 3 Credits
The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary system; forms of administrative responsibility.

POLS 462 Seminar: American Political Thought 3 Credits
Focus on a narrow topic or theorist in the field, e.g., the work of Jefferson, Madison, Hamilton, or Tocqueville. Students will be required to write a major paper and present it to the class.

POLS 463 Public Opinion Research 3 Credits
This course examines fundamental processes and tools employed in public opinion research. This class is designed to provide students with the ability to develop, implement and evaluate various forms of public opinion research including surveys, focus groups and individual interviews. Students will be introduced to numerous aspects of public opinion research including questionnaire design, sampling, interviewing, data analysis, focus group moderation, and varied forms of data collection.

POLS 464 Community Fellowship I 3 Credits
15 hours/week in regional agency on specific project relating to regional redevelopment with regularly scheduled contact hours with the faculty advisor.

POLS 465 Community Fellowship II 3 Credits
15 hours/week in regional agency on specific project relating to regional redevelopment with regularly scheduled contact hours with the faculty advisor.

POLS 466 (EVST 466) Advanced Environmental Policy 3 Credits
An introduction to the history of domestic environmental policy and contemporary policy trends, such as the rise of legal adversarialism and public participation in regulatory decisions. The role of market instruments in policy implementation, the emergence of rights-based approaches to environmental protection, and the role and value of distributional analysis will also be covered. Students will develop knowledge of a particular area of environmental policy at the federal, state, and/or level depending on their interests and current opportunities.

POLS 467 Legal Problems 3 Credits
This course involves an examination of the role of legal rules, agents, institutions, and values in our society. Primary emphasis will be given to the American legal system, though we will evaluate U.S. principles and politics through a comparative lens as well.

POLS 468 Political Economy 3 Credits
Relationship of democratic politics to government and market, and significance of economic power in the American polity. Economic rationale for the place of the market and economic institutions in polity. Emphasis on information in comparison of economic approaches to public policy and organization (public goods, market failure and collective action) with traditional political science approaches (group mobilization and conflict, non-decisions and symbolic actions.

POLS 469 (WGSS 469) The Women's Movement in China 3 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, “did the Party liberate women?”

POLS 473 Globalization and Social Well-Being 3 Credits
This course examines how the various dimensions of globalization impact people by exploring factors that reflect and affect quality of life. Students will gain an understanding of the complexities resulting from the growing interconnectedness and interdependencies of global relations. The course is intended to get people thinking creatively about opportunities for connections that preserve human dignity.

POLS 477 Advanced Computer Applications 3 Credits
Uses of computers in social sciences, including data collection, management, analysis, presentation, and decision-making; includes weekly lab.

POLS 480 The End of Policing? Politics of Social Control 3 Credits
"What are your prime directives? Serve the public trust, protect the innocent, uphold the law" (Robocop 1987). This course focuses on policy design and feedback and is not a course on police procedure or policing tactics. The primary objective of the course is to learn to think critically about public safety and evaluate policies based on their value to democracy.

POLS 481 Special Topics 1-3 Credits
Individual inquiry into some problem of government. Reading, field work, and other appropriate techniques of investigation. Conferences and reports.
Repeat Status: Course may be repeated.

POLS 490 Thesis 1-6 Credits

POLS 491 Special Topics 3 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy.
Repeat Status: Course may be repeated.

POLS 492 Independent Study 1-3 Credits
Individually supervised course in Political Science. Instructor permission required.
Repeat Status: Course may be repeated.

Psychology

The Psychology Department offers B.A. and B.S. undergraduate degrees, an undergraduate minor, and M.S. and Ph.D. graduate degrees in psychology.

Psychology is the science of mind, brain, and behavior. Undergraduate study in psychology provides:

- A knowledge base about how people think, feel, and act as individuals and in groups, from infancy to old age
- An understanding of how psychological principles can be applied in everyday life, including to address societal needs
- Training in scientific reasoning, critical thinking, and problem solving, including effective research methods to address psychological phenomena
- An appreciation of individual, sociocultural, and international diversity
- Opportunities to build skills in writing and oral communication

Psychology majors pursue careers in many areas such as: business (marketing, human resources, industrial/organizational psychology); education; medicine/health; mental and behavioral health professions (clinical, counseling, and sports psychology); law; human services; and basic and applied research positions. The knowledge and skills provided by a degree in Psychology are valuable to all such careers.

For more information, please visit our website: http://psychology.cas.lehigh.edu/ (http://psychology.cas2.lehigh.edu/)

B.A. MAJOR PROGRAM IN PSYCHOLOGY
The Bachelor of Arts in psychology is a social science major situated within the College of Arts and Sciences' liberal arts tradition. The B.A. requires 13 courses (approximately 49 credit hours) in psychology: Introduction to Psychology, four 100-level breadth courses, a 100-level recitation section accompanying one of the breadth courses, a three course research methods and data analysis sequence, and four 300-level seminars. Students are required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major. Students must also fulfill college and university degree requirements.

This flexible program provides rigorous training in psychology while leaving room for double-majoring, pursuing one or more minors, and exploring other opportunities available at Lehigh. Unlike the B.S. major, which requires additional designated courses in math, natural science, and other social sciences, the B.A. major allows students greater freedom in selecting which courses they will take outside of the psychology curriculum.

Transfer credits and study abroad course work may be applied toward the major; however, students must take a minimum of two 100-level

breadth courses, three 300-level seminars, and the PSYC 201, 202, and 203 sequence at Lehigh to complete a psychology major from Lehigh.

Required Core Courses		**16**
PSYC 001	Introduction to Psychology	
PSYC 201	Research Methods and Data Analysis I	
PSYC 202	Research Methods and Data Analysis II	
PSYC 203	Research Methods and Data Analysis III	
Breadth Courses		**14-16**
Four 100-level courses, with a minimum of one from each of the following three areas, are required of all majors. The fourth 100-level breadth course may be selected from any of the courses below, or PSYC 130 Introduction to Health Psychology, or PSYC 138 Psychopathology.		
Cognition and Cognitive Neuroscience		
PSYC/COGS 117	Cognitive Psychology	
PSYC/COGS 176	Cognitive Neuroscience	
Developmental		
PSYC 107	Child Development	
PSYC 109	Adulthood and Aging	
Social and Personality		
PSYC 121	Social Psychology	
PSYC 153	Personality	
100-level Recitation		**1**
One 100-level recitation section accompanying one of the above breadth courses		
PSYC 182	Child Development Recitation	
PSYC 183	Cognitive Psychology Recitation	
PSYC 184	Cognitive Neuroscience Recitation	
PSYC 185	Personality Recitation	
PSYC 186	Social Psychology Recitation	
PSYC 187	Health Psychology Recitation	
Seminars		**15-16**
Four 300-level seminars are required of all B.A. students. Seminars need to span at least two areas. (See list of seminars per area in Psychology Concentrations section below). [1]		
Student Portfolio		
Students are also required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major.		
Total Credits		**46-49**

[1] Students can **not** use PSYC 300, PSYC 310, PSYC 389, PSYC 391, PSYC 392, PSYC 393 or PSYC 394 to fulfill this requirement. All other 300-level psychology courses can be used to fulfill this requirement.

Optional Concentration

Students in the B.A. program may choose to complete an optional concentration. Concentrations are available in four areas: Cognition and Cognitive Neuroscience; Development; Social and Personality Psychology; and Clinical and Behavioral Health. Completion of a concentration involves selecting specific 100-level breadth courses and 300-level seminars within the concentration. See listings of individual concentration courses below.

Recommended Electives

The B.A. program in psychology is a flexible preparation for a number of fields. With suitable selection of additional courses, students can prepare themselves for graduate study in any subfield of psychology or for careers in areas for which psychology is a desirable and relevant major such as neuroscience, law, social work, marketing, management, and education.

Depending on the specific subfield of interest, many courses in other departments within CAS, and in other Colleges, may be relevant. Examples include Biological Sciences (especially the Behavioral Neuroscience program), Philosophy, Sociology and Anthropology, Marketing, Economics, Management, Education, and in the interdisciplinary programs of Cognitive Science; Women, Gender, and Sexuality Studies; Health, Medicine, and Society; Global Studies; and Africana Studies.

For graduate programs in psychology, neuroscience, and related fields, additional coursework in research and statistics is desirable, as is engagement in supervised research and participation in the honors program.

Preparation for programs in health-related areas such as nursing, medicine, and dentistry will include additional coursework in biology, chemistry, and physics. Students should consult with the appropriate pre-professional advisors to determine specific requirements.

Students interested in applying psychology to fields such as law, marketing, social work, management, or education should consult with faculty in those areas to discuss relevant courses.

B.S. MAJOR PROGRAM IN PSYCHOLOGY

The Bachelor of Science in psychology is a highly structured and comprehensive behavioral science major requiring 14 courses (approximately 53 credit hours) in psychology and 9 collateral courses (approximately 31-36 credit hours) as described below. Students are required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major. Students must also fulfill college and university degree requirements.

The B.S. program is intended for psychology majors with strong interests in math and natural sciences. This program may also be attractive to students who are preparing for careers in medicine or related health fields because it incorporates some of the math and natural science courses required for professional study in these fields.

The B.S. program offers broad training in psychological science with a concentration in Cognition and Cognitive Neuroscience; Development; Social and Personality Psychology; or Clinical and Behavioral Health. In addition to the required psychology coursework, the B.S. also includes collateral courses that span three areas (Mathematics and Computer Science; Natural Science; and Social and Cognitive Science). These additional requirements mean that B.S. students have relatively fewer opportunities to pursue coursework outside of the major curriculum. Progression through the program is best served through early commitment. Students who do not declare their majors early may find it difficult to complete the B.S. major program.

Transfer credits and study abroad course work may be applied toward the major; however, students must take a minimum of two 100-level breadth courses, three 300-level seminars, and the PSYC 201, 202, and 203 sequence at Lehigh to earn a psychology major from Lehigh.

Requirements for the B.S. in Psychology

Collateral Requirements

For students in the B.S. program, collateral courses can be used to fulfill the college distribution requirements in mathematics, natural science, and social science. To fulfill natural science college distribution requirements, at least one course must include the associated lab.

Please consult the course listings for information on prerequisites.

Mathematics and Computer Science		**7-8**
Select two from the following:		
MATH 012	Basic Statistics and Data Science	
MATH 043	Survey of Linear Algebra	
Any MATH course 21 or above		
CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	
Any CSE course 007 or above		
Natural Science		**14-16**
Select at least one from the following:		
BIOS 010	Bioscience in the 21st Century	

BIOS 041	Introduction to Cellular and Molecular Biology
EES 025	The Environment and Living Systems
EES 028	Conservation and Biodiversity
PSYC 012	Introduction to Human Neuroscience

Plus three additional courses from the following:

ANTH 012	Intro to Archaeology and Human Origins
PSYC 012	Introduction to Human Neuroscience
Any ASTR course 007 or above	
Any BIOS course 010 or above	
Any CHM course 030 or above	
Any EES course 002 or above	
Any PHY course 010 or above	

Social and Cognitive Science **7-8**

Select any two SS courses that are not cross-listed with psychology.

Possible departments include (but are not limited to): Africana Studies (AAS), Asian Studies (ASIA), Cognitive Science (COGS), Global Studies (GS), Health, Medicine, & Society (HMS), History (HIST), International Relations (IR), Communication (COMM), Latin American & Latino Studies (LAS), Philosophy (PHIL), Political Science (POLS), Religion Studies (REL), Science, Technology, & Society (STS), Sociology and Anthropology (ANTH, SOAN, SOC), Women, Gender, & Sexuality Studies (WGSS) [1,2]

Additional Coursework **3-4**

Select any one additional course from the above lists. [3]

Total Credits **31-36**

1 Courses may not be cross-listed with Psychology.

2 Courses must have a SS designation.

3 Students are strongly encouraged to discuss their interests and career goals with their advisor before selecting courses.

Psychology Requirements

Required Core Courses **16**

PSYC 001	Introduction to Psychology
PSYC 201	Research Methods and Data Analysis I
PSYC 202	Research Methods and Data Analysis II
PSYC 203	Research Methods and Data Analysis III

Breadth Courses **14-16**

Four 100-level courses, with a minimum of one from each of the following three areas, are required of all majors. The fourth 100-level breadth course is determined by the concentration being pursued and may be selected from any of the courses below, or PSYC 130 Introduction to Health Psychology, or PSYC 138 Psychopathology.

Cognition and Cognitive Neuroscience	
PSYC/COGS 117	Cognitive Psychology
PSYC/COGS 176	Cognitive Neuroscience
Developmental	
PSYC 107	Child Development
PSYC 109	Adulthood and Aging
Social and Personality	
PSYC 121	Social Psychology
PSYC 153	Personality

100-level Recitation **1**

One 100-level recitation section accompanying one of the above breadth courses

PSYC 182	Child Development Recitation
PSYC 183	Cognitive Psychology Recitation
PSYC 184	Cognitive Neuroscience Recitation
PSYC 185	Personality Recitation
PSYC 186	Social Psychology Recitation
PSYC 187	Health Psychology Recitation

Seminars **18-20**

Five 300-level seminars are required of all B.S. students. Seminars need to span at least two areas. (See list of seminars per area in Psychology Concentrations section below.) [1]

Student Portfolio

Students are also required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major.

Total Credits **49-53**

1 Students can **not** use PSYC 300, PSYC 310, PSYC 389, PSYC 391, PSYC 392, PSYC 393 or PSYC 394 to fulfill this requirement. All other 300-level psychology courses can be used to fulfill this requirement.

PSYCHOLOGY CONCENTRATIONS

Concentrations are available in four areas: Cognition and Cognitive Neuroscience; Development; Social and Personality Psychology; and Clinical and Behavioral Health. Students in the B.A. major program may choose to complete a concentration. Students in the B.S. major program are required to complete a concentration. Completion of a concentration involves selecting two specific 100-level breadth courses and three 300-level seminars within the concentration area.

Cognition and Cognitive Neuroscience Concentration

Specified 100-level breadth courses, take both:

PSYC/COGS 117	Cognitive Psychology
PSYC/COGS 176	Cognitive Neuroscience

300-level seminars, choose three:

PSYC 307	Higher Order Cognition
PSYC/HMS 344	Health Care Reasoning and Decision Making
PSYC 347	Topics in Memory
PSYC 351	Children's Thinking
PSYC 355	Seminar in Cognitive Neuroscience
PSYC/EVST 357	Psychology of Environmental Issues
PSYC 362	Cognition in Practice & Policy
PSYC 371	Special Topics in Cognition & Cognitive Neuroscience
PSYC 377	Attention and Attentional Failures
PSYC 382	Endocrinology

Development Concentration

Specified 100-level breadth courses, take both:

PSYC 107	Child Development
PSYC 109	Adulthood and Aging

300-level seminars, choose three:

PSYC 328	Educational Psychology
PSYC 329	Peer Relationships and Development in Childhood and Adolescence
PSYC 338	Phenomenology and Theory of Childhood Disorders
PSYC 346	Child Development and Social Policy
PSYC 351	Children's Thinking
PSYC 352	Adolescence and Emerging Adulthood
PSYC 363	Personality and Social Development in Childhood

PSYC 372	Special Topics in Developmental Psychology
PSYC 375	Development of Good and Evil
PSYC 378	Emotional Development
PSYC/HMS 386	Pediatric Psychology

Social and Personality Psychology Concentration

Specified 100-level breadth courses, take both:	
PSYC 121	Social Psychology
PSYC 153	Personality
300-level seminars, choose three:	
PSYC/HMS 302	Stress and Coping
PSYC 311	The Psychology of Stereotyping, Prejudice, and Discrimination
PSYC 313	Person Perception
PSYC 314	Social Cognition
PSYC 330	Contemporary Topics in Industrial/ Organizational Psychology
PSYC 331	Political Psychology
PSYC 332	The Psychology of Morality
PSYC 341	Social Psychology and Social Issues
PSYC/HMS 349	Participatory and Action Research in Psychology
PSYC 350	The Psychology of Evil
PSYC 353	Social Justice and Social Change
PSYC/EVST 357	Psychology of Environmental Issues
PSYC 363	Personality and Social Development in Childhood
PSYC 373	Special Topics in Social & Personality Psychology
PSYC 375	Development of Good and Evil
PSYC 378	Emotional Development
PSYC 384	Self and Identity

Clinical and Behavioral Health Concentration

Specified 100-level breadth courses, choose two of three:	
PSYC/HMS 130	Introduction to Health Psychology
PSYC/HMS 138	Psychopathology
PSYC 153	Personality
300-level seminars, choose three:	
PSYC/HMS 302	Stress and Coping
PSYC 319	The Psychology of Trauma
PSYC/HMS 327	Advanced Topics in Health Psychology
PSYC/HMS 334	The Psychology of Body Image and Eating Disorders
PSYC 338	Phenomenology and Theory of Childhood Disorders
PSYC/HMS 344	Health Care Reasoning and Decision Making
PSYC 346	Child Development and Social Policy
PSYC/HMS 348	Drugs and Behavior
PSYC 354	Psychological Assesssment
PSYC 367	Clinical Psychology
PSYC 374	Special Topics in Clinical & Behavioral Health
PSYC 378	Emotional Development
PSYC 379	Grief, Anxiety, and Resilience
PSYC 380	Sports Psychology
PSYC/HMS 386	Pediatric Psychology

DEPARTMENT HONORS IN PSYCHOLOGY

Students in either the B.A. or B.S. degree programs may undertake a program that leads to graduation with department honors. The honors program permits majors of unusual academic ability and interest to explore topics in greater depth than the curricula normally allow. Under faculty supervision, a student normally spends the first semester of the senior year enrolled in PSYC 391 doing library research, learning the appropriate methodology, and preparing a written proposal and oral presentation. In the second semester, while the student is enrolled in PSYC 392, the proposal is implemented, culminating in a written honors thesis and oral presentation.

In the junior year, students may apply for the honors program with the department Honors Program Director. To be eligible to participate in the honors program, a student must maintain overall and major GPAs of 3.5.

MINOR PROGRAM

General Psychology

The general psychology minor consists of a minimum of five courses in psychology including the introductory course (PSYC 001). At least three of the five required psychology courses must be taken at Lehigh. Each course must be at least three credits.

FOR GRADUATE STUDENTS

The Department of Psychology offers a distinctive, research-intensive graduate program with specializations in cognitive, developmental and social psychology. The department accepts mainly Ph.D. students, who obtain a master's degree in the process of working for the doctorate. However, well-qualified students may also be accepted for a Master of Science degree. Students are trained primarily for positions at universities, and in basic or applied research settings. For more information visit: https://psychology.cas.lehigh.edu/graduate (https://psychology.cas.lehigh.edu/graduate/).

In addition, we offer a non-degree Graduate Certificate in Cognitive Science in collaboration with the Cognitive Science Program. Information is available at: https://psychology.cas.lehigh.edu/graduate/cognitive-science-graduate-certificate (https://psychology.cas.lehigh.edu/graduate/cognitive-science-graduate-certificate/).

Requirements for a Ph.D. in the Department of Psychology

Research

All graduate students are expected to be involved in research throughout their graduate careers. There are also several formal research requirements of the program.

First-Year Apprenticeship

First-year students are expected to choose an advisor and begin to work on research projects as early as possible. An oral report of the student's research activities is made to the department. Students will submit a draft Master's Thesis Proposal by June 1 of the first year of the Ph.D. program.

Master's Thesis

A master's thesis (usually empirical or data-based) is required. An oral presentation of the thesis is made to the department. Students entering with a master's degree may instead conduct an equivalent non-degree Pre-dissertation Project.

Third-Year independent scholarly activity

Third year students will work toward formulation of their dissertation proposal by completing a literature review or writing a small grant proposal. By the end of the third year of the Ph.D. program, students will choose a dissertation committee, and meet to report on their research activities.

Doctoral Dissertation

This is an original piece of scholarly work usually involving empirical research, although original theoretical or historical research is possible with faculty approval.

Course work

For the Ph.D., the minimum course requirements include:

- Three core courses covering cognitive psychology (PSYC 403), developmental psychology (PSYC 402), and social cognition (PSYC406);
- Two courses in statistics and research methodology (PSYC 421 and PSYC 422);
- At least three graduate seminars (PSYC 430 and above);

- Two elective courses, approved by the advisor;
- A professional development seminar (PSYC 409)

Teaching

Students are encouraged to participate in teaching as appropriate for their training throughout their graduate years. Normally, students begin as teaching assistants and progress to teaching independently.

General Examination

A general examination is required for all doctoral candidates and will be completed at the end of the second year of the Ph.D. program. Readings and questions for the exam will be compiled by faculty in the student's specialization area.

Psychology, PhD

PSYC 409	Professional Seminar I	1
Core Courses		
PSYC 402	Developmental Psychology	
PSYC 403	Cognitive Psychology	
PSYC 406	Social Cognition	
Statistics and Research Methodology		
PSYC 421	Statistical Analysis of Psychological Data I	
PSYC 422	Statistical Analysis of Psychological Data II	
Graduate Seminars [1]		
Two PSYC Elective Courses [2]		
Research Credits [3]		

1

At least three graduate seminars (PSYC 430 and above)

2

Two elective courses chosen in consultation with the advisor.

3

To reach 72 total credits (or 48 post-Masters), students should also register for appropriate credits of PSYC 412 First-Year Project; PSYC 490 Thesis Research; and PSYC 461 Research Seminar.

Requirements for a Master of Science in the Department of Psychology

Research

Master of Science students will complete the First-Year Apprenticeship and Master's Thesis requirements as described in the Ph.D. section above.

Coursework

For the M.Sc., the minimum course requirements include:

Psychology, MS

Choose Two Core Courses		
PSYC 402	Developmental Psychology	
PSYC 403	Cognitive Psychology	
PSYC 406	Social Cognition	
Statistics & Research Methodology		
PSYC 421	Statistical Analysis of Psychological Data I	
PSYC 422	Statistical Analysis of Psychological Data II [1]	
Two PSYC Elective Courses [2]		
PSYC 409	Professional Seminar I	1
PSYC 412	First Year Research Project [3]	1-3
PSYC 490	Thesis Research [4]	1-6
Total Credits		**30**

1

Or Approved Equivalent

2

Elective courses chosen in consultation with the advisor.

3

A total of 5 credits for PSYC 412 are required.

4

A total of 6 credits for PSYC 490 are required.

Evaluation

Graduate students are evaluated on their performance in coursework, research and scholarship, teaching assistantship assignments, and the general examination. The faculty provides each student with an annual written evaluation of their progress in the graduate program.

Financial Support

Support for Ph.D. students is available in the form of teaching and research assistantships, fellowships and scholarships.

How To Apply

Information about admission and financial aid can be obtained from the Department of Psychology or found at: https://psychology.cas.lehigh.edu/graduate/admissions-information (https://psychology.cas.lehigh.edu/graduate/admissions-information/). While a strong undergraduate background in psychology is desirable, promising students with majors other than psychology are encouraged to apply. A complete application--containing all requested information--should be submitted no later than **December 15th**. New students are normally accepted for entrance into the program only for the fall semester. To apply, please begin here: https://psychology.cas.lehigh.edu/graduate/admissions-information (https://psychology.cas.lehigh.edu/graduate/admissions-information/). Please note that our department deadline of December 15th supersedes any deadline you might see elsewhere (e.g., on the College of Arts and Sciences website).

Courses

PSYC 001 Introduction to Psychology 4 Credits
Psychology as a science of behavior. Natural science aspects such as learning, sensation-perception, and physiological bases; and social science aspects such as human development, intelligence, and personality. Methodologies appropriate to these areas, and related societal problems.
Attribute/Distribution: SS, SW

PSYC 012 Introduction to Human Neuroscience 4 Credits
In this introductory course, we will uncover how our brains are able to give rise to the complexities of human thought and behavior. We will examine the neural bases of seeing, hearing, sleep, dreaming, sexual behavior, emotion, aggression, behavioral disorders, learning, and memory.
Attribute/Distribution: NS, NW, Q

PSYC 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 107 Child Development 4 Credits
Survey of theories and research concerning physical, perceptual, cognitive, social, and emotional development from conception through adolescence, and the various factors and contexts (e.g., genes, parenting, peers, school, culture) that influence developmental processes. May not be taken pass/fail. Open to Freshmen with departmental permission.
Prerequisites: PSYC 001 or SOC 001
Attribute/Distribution: SS, SW

PSYC 109 Adulthood and Aging 4 Credits
Social science approaches to the latter two-thirds of life. Cognitive and personality development; attitudes toward aging; social behavior of older adults; widowhood; retirement. May not be taken pass/fail. Open to Freshmen with departmental permission.
Prerequisites: PSYC 001 or SOC 001
Attribute/Distribution: SS, SW

PSYC 115 (REL 115) Religion And Psychology 4 Credits
A study of the origins, development and consequences of religion from a psychological perspective. Attention will be given to classic and contemporary sources, with a focus on major psychoanalytic theorists of religion (Freud, Jung, Erikson); psychological analyses of religious experience (e.g., Wm. James, Victor Frankl); and the diverse cultural and religious forms that structure the connection between religion and psychology (e.g., Buddhist psychology, Japanese Morita therapy).
Attribute/Distribution: HE, HU

PSYC 117 (COGS 117) Cognitive Psychology 4 Credits
The architecture and dynamics of the human mind: How we acquire knowledge through perception, represent and activate it in memory, and use it to communicate, make decisions, solve problems, and reason creatively. May not be taken pass/fail.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: SS, SW

PSYC 121 Social Psychology 4 Credits
Theories, methods of investigation, and results of research on the way social and psychological processes interact in human behavioral settings. Topics include analysis of self and relationships, dynamics of small groups, attitudes and persuasion, prejudice, prosocial and antisocial behavior. May not be taken pass/fail. Open to Freshmen with departmental permission.
Prerequisites: SOC 001 or PSYC 001
Attribute/Distribution: CC, SS, SW

PSYC 130 (HMS 130) Introduction to Health Psychology 4 Credits
This course explores the psychological processes that influence how people stay healthy, why people get sick, and how people respond to illness. The course also examines what the study of health psychology has to teach us about illness prevention and the provision of health care services. May not be taken pass/fail.
Attribute/Distribution: SS, SW

PSYC 138 (HMS 138) Psychopathology 4 Credits
Examines research and theory on the patterns, causes, and treatment of various forms of psychopathology. May not be taken pass/fail.
Prerequisites: PSYC 001
Attribute/Distribution: SS, SW

PSYC 153 Personality 4 Credits
Examination of the major theoretical frameworks psychologists use to understand human thought, feeling, and behavior. Whereas these frameworks each emphasize very different concepts (e.g., the unconscious mind vs. culture vs. neurotransmitters), they are united in their effort to answer the question: Why does a given individual think, feel, or behave as she does? May not be taken pass/fail. Open to Freshmen with departmental permission.
Prerequisites: PSYC 001 or SOC 001
Attribute/Distribution: SS, SW

PSYC 160 Independent Study 1-3 Credits
Readings on topics selected in consultation with a staff member. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 001
Attribute/Distribution: SS

PSYC 161 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty supervision. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: SS

PSYC 162 Psychological Field Work 1-3 Credits
Work-study practice including supervised experience in one of several local agencies. Development of familiarity with the operations of the agency and working with individual patients or students. Must have completed two additional psychology courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 001
Attribute/Distribution: SS

PSYC 176 (COGS 176) Cognitive Neuroscience 4 Credits
Perception and cognitive neuroscience as the link between mental processes and their biological bases. Visual and auditory perception; the control of action; neuropsychological syndromes of perception, language, memory and thought; neural network (connectionist) models of mental processes. May not be taken pass/fail.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: NS, NW

PSYC 182 Child Development Recitation 1 Credit
Research, discussion, and analysis of topics in child development.
Prerequisites: PSYC 107
Can be taken Concurrently: PSYC 107
Attribute/Distribution: ND

PSYC 183 (COGS 183) Cognitive Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive psychology.
Prerequisites: PSYC 117 or COGS 117
Can be taken Concurrently: PSYC 117, COGS 117

PSYC 184 (COGS 184) Cognitive Neuroscience Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive neuroscience.
Prerequisites: PSYC 176 or COGS 176
Can be taken Concurrently: PSYC 176, COGS 176
Attribute/Distribution: ND

PSYC 185 Personality Recitation 1 Credit
Research, discussion, and analysis of topics in personality.
Prerequisites: PSYC 153
Can be taken Concurrently: PSYC 153

PSYC 186 Social Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in social psychology.
Prerequisites: PSYC 121
Can be taken Concurrently: PSYC 121

PSYC 187 Health Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in health psychology.
Prerequisites: PSYC 130 or HMS 130
Can be taken Concurrently: PSYC 130, HMS 130

PSYC 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 201 Research Methods and Data Analysis I 0,4 Credits
Part 1 of a course sequence on how to design and analyze psychological research. This course sequence focuses on developing research questions and answering them using appropriate research designs and complementary data analysis techniques: descriptive statistics, hypothesis testing, correlation, regression, chi-square, t-test, analysis of variance. Three hours of lecture and 75-minute recitation.
Prerequisites: PSYC 001
Attribute/Distribution: Q

PSYC 202 Research Methods and Data Analysis II 0,4 Credits
Part 2 of a course sequence on how to design and analyze psychological research. This course sequence focuses on developing research questions and answering them using appropriate research designs and complementary data analysis techniques: descriptive statistics, hypothesis testing, correlation, regression, chi-square, t-test, analysis of variance. Three hours of lecture and 75-minute recitation.
Prerequisites: PSYC 201
Attribute/Distribution: Q

PSYC 203 Research Methods and Data Analysis III 0,4 Credits
Part 3 of a course sequence on how to design and analyze psychological research. Students will design, conduct, and analyze behavioral research studies and develop skills in scientific writing.
Prerequisites: PSYC 201 and PSYC 202
Attribute/Distribution: Q, W, WRIT

PSYC 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 300 Apprentice Teaching 1-4 Credits

PSYC 302 (HMS 302) Stress and Coping 4 Credits
How does stress affect the psychological system, and what psychological mechanisms are in place to help people overcome environmental stressors? This seminar examines classic and contemporary theories and research on stress, coping, and social support.
Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180
Attribute/Distribution: SS

PSYC 307 Higher Order Cognition 4 Credits
In depth exploration of selected areas of higher level cognition such as thinking and reasoning, metacognition, expertise, executive processes, language and thought.
Prerequisites: PSYC 117 or COGS 117
Attribute/Distribution: SS, W

PSYC 310 Advanced Research Methods in Psychology 4 Credits
Experimental and nonexperimental research design; Sampling and selection from populations; Data exploration; Quantitative and qualitative measurement and analysis; Computer-based data collection; and other specialized topics.
Prerequisites: PSYC 203

PSYC 311 The Psychology of Stereotyping, Prejudice, and Discrimination 4 Credits
We first examine the basic cognitive processes that make stereotyping a functional aspect of everyday cognition, and then turn toward examining emotional, motivational, and personality differences that affect one's level of prejudice. Finally, we will study the role of social forces in transmitting prejudice (parents, schools, religion, media) and the impact of societal prejudice (discrimination) on those who are the targets of prejudice. How stereotypes, prejudice, and discrimination are understood, measured, expressed, and altered is the focus of the course.
Prerequisites: PSYC 153 or PSYC 121
Attribute/Distribution: CC, SS, W

PSYC 313 Person Perception 4 Credits
Psychological processes involved in forming impressions of others. Survey of the factors that influence the way in which we think about the people who make up our social environment and of the laboratory methods with which experimental social psychology investigates person perception. The emphasis is on demonstrating the joint impact of the behaviors performed by others and the biases/expectancies that we bring into the social setting.
Prerequisites: PSYC 153 or PSYC 121
Attribute/Distribution: CC, SS, W

PSYC 314 Social Cognition 4 Credits
Examines the cognitive processes through which people make sense of social groups, individual others, themselves, and the world. Topics include judgment and decision making, attitudes and persuasion, ordinary personology, stereotyping and prejudice, and the self.
Prerequisites: PSYC 121
Attribute/Distribution: CC, SS, W

PSYC 319 (HMS 319) The Psychology of Trauma 4 Credits
This course explores the nature of psychological trauma, including the physiological, emotional, cognitive, behavioral, interpersonal, and developmental impact of exposure to extreme stress and traumatic events. Historical and current perspectives on the individual and cultural effects of trauma will be examined, including consequences of relational trauma, traumatic loss, injury/illness, crime, combat exposure, terrorism, natural disasters, and vicarious traumatization. Posttraumatic Stress Disorder and related conditions will be explored, as will the nature of effective intervention techniques, recovery, adaptive coping, and resilience.
Prerequisites: PSYC 138 or HMS 138
Attribute/Distribution: SS

PSYC 327 (HMS 327) Advanced Topics in Health Psychology 4 Credits
This course provides an overview of the psychological study of health. The course explores psychological theories that aim to explain health behavior (e.g., why do people smoke?) and the role of psychology in understanding the experience of illness. This course also examines how psychological research and theory can be applied to promote health behavior (e.g., how can we design interventions to promote physical activity).
Prerequisites: PSYC 130 or HMS 130
Attribute/Distribution: SS, W

PSYC 328 Educational Psychology 4 Credits
Overview of historical, contemporary, and emerging issues in the field of educational psychology with an emphasis on connections between theory and instructional practice.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 329 Peer Relationships and Development in Childhood and Adolescence 4 Credits
This course focuses on children and adolescents' development within the context of their relationships with peers. In this course we will examine how close friendships, the broader peer group, and romantic relationships influence youths' development and well-being (e.g., the development of psychopathology), how individual characteristics affect peer relations (e.g., gender identity), and contextual factors that impact peer relationship (e.g., sociocultural background).
Prerequisites: PSYC 107
Attribute/Distribution: SS, W

PSYC 330 Contemporary Topics in Industrial/Organizational Psychology 4 Credits
Industrial / Organizational Psychology is the application of psychological principles, tools, and theories to the workplace. This subdiscipline employs a scientist-practitioner model in the quest to optimize fit between persons, jobs, and the organizational environment. Optimization criteria include finding a balance between productivity and quality of work life for workers. Motivation, leadership, personality, stress, feedback, technology, diversity, and human potential are some of the themes explored amidst a changing landscape of challenges to the world of work.
Prerequisites: PSYC 121 or PSYC 153
Attribute/Distribution: SS

PSYC 331 Political Psychology 4 Credits
This course provides an overview of social scientific methods and theories that examine how people think, feel, and act in politics. A primary goal is to identify ways in which psychological theory contributes to our understanding of politics, and how the study of politics advances our understanding of human nature. Topics include the psychology of public opinion and mass belief systems, media and persuasion, intergroup relations, leadership, and various forms of political engagement including voting, protest and advocacy.
Prerequisites: (PSYC 001)
Attribute/Distribution: SS

PSYC 332 The Psychology of Morality 4 Credits
We begin with the Big Questions: Are human beings intrinsically good? How potent is our intrinsic capacity for goodness? What does it mean to be "good" or "moral"? How can we answer these questions? Next, we examine a variety of motives, capacities, and emotions that can promote our "good" behavior. Some examples include empathy, compassion (and other moral emotions), the justice motive, the norm enforcement motive, moral intuitions, social bonds, and perhaps even our general capacity for reason.
Prerequisites: PSYC 121
Attribute/Distribution: CC, SS, W

PSYC 334 (HMS 334, WGSS 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.
Attribute/Distribution: SS, W

PSYC 335 (BIOS 335) Animal Behavior 3 Credits
Discussion of the behavior of invertebrates and vertebrates and analysis of the physiological mechanisms responsible for behavioral actions, and adaptive value of specific behavior patterns.
Prerequisites: BIOS 044
Attribute/Distribution: NS

PSYC 338 Phenomenology and Theory of Childhood Disorders 4 Credits
The nature, classification, and treatment of childhood disorders.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 341 Social Psychology and Social Issues 4 Credits
This course examines the methods, concepts, and research findings associated with the effort to apply social psychology to the understanding and amelioration of social problems. Special attention will be paid to the topic of human conflict.
Attribute/Distribution: SS

PSYC 344 (HMS 344) Health Care Reasoning and Decision Making 4 Credits
Health care professionals diagnose physical and mental illnesses and create treatment plans to improve their patients' health. How do these professionals make decisions related to these important issues? We will explore the literature on how medical and mental health professionals reason and make decisions about health care issues. Topics to be covered include diagnosis, treatment decisions, access to care, and how these reasoning processes are swayed. Consideration will be given to patient decision-making as well.
Prerequisites: PSYC 117 or COGS 117 or PSYC 130 or HMS 130 or COGS 007 or HMS 160 or HMS 180
Attribute/Distribution: SS, W

PSYC 346 Child Development and Social Policy 4 Credits
This course explores the intersection of child development research and social policy. We will examine what we know about healthy child development from current research and how it can help inform and improve existing programs, policies, and recommendations for children and families. Topics include critical social policy issues such as child care, early childhood education, child abuse, divorce and child custody, adolescent pregnancy, poverty, bullying, and technology and media.
Prerequisites: PSYC 107
Attribute/Distribution: CC, SS, W

PSYC 347 Topics in Memory 4 Credits
This seminar explores the brain systems and neural mechanisms involved in the formation and retrieval of memories. Topics include mechanisms of storage, retrieval and forgetting in normal and clinical populations, emotional memory systems, superior autobiographical memory, role of sleep, and effects of stress on memory.
Prerequisites: PSYC 117 or COGS 117 or PSYC 176 or COGS 176
Attribute/Distribution: NS

PSYC 348 (HMS 348) Drugs and Behavior 4 Credits
Why are some people more vulnerable to substance use problems than others? How can we effectively address substance abuse in our society? This course explores theories and research on the complex psychological, social, and biological factors that contribute to substance use and disorders. Topics include theories of addiction, characteristics of illegal and legal drugs, risk and protective factors, and research on substance abuse prevention.
Prerequisites: PSYC 130 or HMS 130 or HMS 160 or HMS 180
Attribute/Distribution: SS, W

PSYC 349 (HMS 349) Participatory and Action Research in Psychology 4 Credits
Action research is used to understand important real-world social problems and promote social action. Participatory research engages community members as equals to help identify areas of focus and to design studies and interventions. This course provides an overview of the rich history of these approaches in psychology, an in-depth look at how they can be used effectively, and an opportunity to gain hands-on experience.
Prerequisites: PSYC 121 or PSYC 153 or PSYC 130 or HMS 130 or HMS 160 or HMS 180
Attribute/Distribution: SS

PSYC 350 The Psychology of Evil 4 Credits
It has been said that no animal could ever be as cruel as a human being. Indeed, human beings have a notable propensity for inflicting harm on other human beings: Physical assault, homicide, torture, and even genocide. What is the psychology behind such actions? What are the root causes? In exploring these questions, we will consider the issue of what, if anything, can be done to reduce evil in the world.
Prerequisites: PSYC 121 or PSYC 153
Attribute/Distribution: CC, SS, W

PSYC 351 Children's Thinking 4 Credits
This course examines the development of children's thinking from infancy through adolescence. We will discuss current research and theories on the content of children's knowledge and how mental abilities develop. We will also consider the implications of research on children's thinking for real-world questions about parenting, education, and policy-making. Topics include memory, concepts, social cognition, language, reading, mathematics, and individual and cultural differences.
Prerequisites: PSYC 107 or PSYC 117 or COGS 007 or COGS 117
Attribute/Distribution: SS, W

PSYC 352 Adolescence and Emerging Adulthood 4 Credits
Adolescence is a dynamic development period encompassing multiple interrelated changes in the biological, cognitive, psychological, and social domains. This course will cover theories and research in adolescence and explore connections between research and policy. We will also consider whether emerging adulthood is a separate stage of development.
Prerequisites: PSYC 107
Attribute/Distribution: CC, SS, W

PSYC 353 Social Justice and Social Change 4 Credits
How do people decide to engage in collective action to challenge social injustice? We will examine motivators and tactics of resistance, as well as barriers to change, against the historical backdrop of the civil rights movement and in the context of current societal and global disparities.
Prerequisites: PSYC 121
Attribute/Distribution: CC, SS

PSYC 354 Psychological Assesssment 4 Credits
Basic concepts in the construction, selection, administration, scoring, and interpretation of assessment procedures commonly used in psychology. Selection and evaluation of assessment procedures. Supervised experience administering, scoring, and interpreting assessment procedures.
Prerequisites: PSYC 202
Attribute/Distribution: SS

PSYC 355 Seminar in Cognitive Neuroscience 4 Credits
How have measures of brain activity contributed to our understanding of human information processing? Discoveries from 'peering into the brain' have led to conclusions that would have been impossible using behavioral measures alone. In this course we will examine topics that highlight the unique benefit of cognitive neuroscience techniques to the understanding of human cognition.
Prerequisites: PSYC 176 or COGS 176
Attribute/Distribution: NS, Q, W

PSYC 357 (EVST 357) Psychology of Environmental Issues 4 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they perceive environmental risk and make decisions. We will also consider environmental communication and attitude and behavior change, exploring arenas ranging from patterns of consumption and recycling to climate change. Research methods for investigating these issues will be introduced.
Prerequisites: PSYC 001
Attribute/Distribution: CC, SS

PSYC 362 Cognition in Practice & Policy 4 Credits
Taking the study of cognition from principle to practice, this course examines how basic research and theory informs understanding of human performance in real-world settings. Topics will be chosen from domains such as automobile safety, environmental and medical decision-making, human-technology interaction, spatial navigation, and breakdown of cognition under fatigue and alcohol. Public policy implications will be considered.
Prerequisites: PSYC 117 or COGS 007 or COGS 117
Attribute/Distribution: SS, W

PSYC 363 Personality and Social Development in Childhood 4 Credits
Issues related to social development (e.g., attachment, social competence), social contexts (e.g., family, day care), and personality development (e.g., sex roles, aggression, temperament) from infancy through adolescence.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 366 Seminar In Cognitive Aging 4 Credits
Information processing by older adults: perception, attention, memory, speech and text processing and comprehension. The course will also examine the effects on cognitive processing of such diseases as Alzheimer's and Parkinson's.
Prerequisites: PSYC 109
Attribute/Distribution: SS

PSYC 367 Clinical Psychology 4 Credits
The science and profession of helping people overcome psychological problems. Theories of human personality and abnormality in relation to techniques for assessing and treating psychosocial problems and in the light of empirical evidence of validity and effectiveness. Professional issues are also covered.
Prerequisites: PSYC 138 or HMS 138
Attribute/Distribution: SS

PSYC 371 Special Topics in Cognition & Cognitive Neuroscience 4 Credits
Topics within cognition and cognitive neuroscience vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 372 Special Topics in Developmental Psychology 4 Credits
Topics within developmental psychology vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 373 Special Topics in Social & Personality Psychology 4 Credits
Topics within social and personality psychology vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 374 Special Topics in Clinical & Behavioral Health 4 Credits
Topics within clinical and behavioral health vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.

PSYC 375 Development of Good and Evil 4 Credits
The goal of the course is to trace the origins of children's good (i.e., prosocial and moral) and evil (i.e., aggressive and bullying) behavior. We will examine the biological (e.g., genetic), cognitive (e.g., social information processing), and contextual factors (e.g., media, parenting, neighborhoods, and peers) that contribute to the development of children's good and evil behavior.
Prerequisites: PSYC 107
Attribute/Distribution: CC, SS

PSYC 377 Attention and Attentional Failures 4 Credits
Attention allows us to function in complex environments where there is more information than we could possibly process all at once and failures of attention can have drastic consequences. Experimental and neuropsychological evidence will be surveyed for topics including basic attentional phenomena, the role of attention in everyday tasks, and the impact of attentional failures from mind wandering to neuropsychological deficits like ADHD.
Prerequisites: PSYC 117 or PSYC 176 or COGS 007 or COGS 117 or COGS 176
Attribute/Distribution: SS, W

PSYC 378 Emotional Development 4 Credits
The course will cover selected topics in emotional development from infancy through adulthood. Topics will include: infant attachment (learning to love), romantic attachment (being in love), emotion regulation, sympathy/empathy, anger/aggression, temperament, etc. We will also discuss the ways in which significant relationships with peers and parents shape children's emotional development.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 379 (HMS 379) Grief, Anxiety, and Resilience 4 Credits
Grief and anxiety are familiar experiences for many people, and for some they can become debilitating. How can we understand the role these experiences play in a person's life? In this course, we will explore diverse perspectives on grief and anxiety. We will also explore the possibility of being resilient to these experiences, even becoming stronger in the face of adversity. As part of this exploration, we will spotlight the biographies of historical figures who have written about their experiences.
Prerequisites: PSYC 121 or PSYC 130 or PSYC 153 or HMS 130 or HMS 160 or HMS 180 or SOC 160
Attribute/Distribution: SS

PSYC 380 Sports Psychology 4 Credits
Theory, research and application comprise this focal area of psychology. The course will allow students to explore the theory and research giving rise to individual, team, and peak performance assessment and interventions. Topics will include assessment, affect modulation, imagery, cognitive formulation, and psychodynamic development.
Prerequisites: PSYC 153 or PSYC 202
Attribute/Distribution: SS

PSYC 381 Special Topics In Psychology 4 Credits
Topics vary from semester to semester. Topics are presented at an advanced level. Previous course work in psychology and consent of faculty sponsor is required.
Repeat Status: Course may be repeated.

PSYC 382 (BIOS 382) Endocrinology 3 Credits
Organization and function of endocrine and neuroendocrine systems in regulating physiology and behavior. Emphasis on mammalian systems. Focus on critical thinking and problem-solving with reference to basic literature.
Prerequisites: BIOS 044
Attribute/Distribution: NS

PSYC 384 Self and Identity 4 Credits
We will examine different types of identity (e.g., personal, relational, collective) and the cognitive processes that allow for a multifaceted yet unified sense of self. We will study how self-related motives (e.g., enhancement, consistency, distinctiveness) influence self-knowledge, self-regulation, and mental health. Finally, we will explore the origins of self from evolutionary, neuroscientific, and cultural perspectives.
Prerequisites: PSYC 121 or PSYC 153
Attribute/Distribution: CC, SS

PSYC 386 (HMS 386) Pediatric Psychology 4 Credits
Focuses on developmental research and theory related to health and wellness issues in children and adolescents. Topics include children's understanding of biology and disease, disease management, medical consent, education and policy efforts to promote children's health.
Prerequisites: PSYC 107 or PSYC 130 or HMS 130
Attribute/Distribution: SS

PSYC 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

PSYC 391 Thesis 4 Credits
Written report: Literature review and design of project in selected area of psychology. Only open to students in the honors program. Consent of Honors Program Coordinator required.
Prerequisites: PSYC 203
Attribute/Distribution: W

PSYC 392 Honors Thesis 3 Credits
Execution of project designed in PSYC 391. Final report and oral presentation. Only open to students in the honors program. Consent of Honors Program Coordinator required.
Prerequisites: PSYC 391
Attribute/Distribution: W

PSYC 393 Independent Research 1-3 Credits
Individual research projects designed and executed in collaboration with faculty sponsor. Regular meetings with sponsor to give progress reports and receive feedback. Student reads relevant literature and writes report in APA format. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 161 or PSYC 203

PSYC 394 Senior Research Project 3 Credits
Literature review, design and execution of project in selected area of psychology. Intended for senior majors in psychology. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.

PSYC 402 Developmental Psychology 3 Credits
Survey of theories and research concerning perceptual, cognitive, social, and personality development through infancy and childhood. Must have graduate standing or consent of instructor.

PSYC 403 Cognitive Psychology 3 Credits
Survey of theories and research in cognitive psychology. Must have graduate standing or consent of instructor.

PSYC 404 (BIOS 404) Behavioral Neuroscience 3 Credits
Theoretical and empirical issues in biopsychology. Must have graduate standing or consent of instructor.

PSYC 406 Social Cognition 3 Credits
Theory and research on cognitive processes in personality and social functioning. The self, personality consistency and change, causal attributions, social judgment, goals and self-regulation, and mood and emotion. Topics may vary. Must have graduate standing or consent of instructor.

PSYC 409 Professional Seminar I 1 Credit
For students entering the Ph.D. program: Acculturation to graduate school and the Psychology Ph.D. program in particular; professional issues of relevance to individuals at the outset of a research career in psychology. Department permission required.

PSYC 410 Professional Seminar II 1 Credit
For students nearing graduation: Professional issues of special relevance to Psychology Ph.D. students preparing for academic or nonacademic postdoctoral employment. Department permission required.

PSYC 412 First Year Research Project 1-3 Credits
Research project or paper to be completed by June of the first year of the Ph.D. program under the direction of a faculty advisor. May be repeated in second semester of program.
Repeat Status: Course may be repeated.

PSYC 421 Statistical Analysis of Psychological Data I 3 Credits
First of a two-semester sequence covering essential issues in statistical analysis as practiced by psychologists. Topics include data description, probability, z and t-tests, general linear model, simple correlation/regression, univariate analysis of variance, chi-square. Emphasis on connecting research designs to appropriate statistical tests, data interpretation, and implementation in statistical packages. Department permission required.

PSYC 422 Statistical Analysis of Psychological Data II 3 Credits
Second course of the two-semester statistics sequence. Topics include advanced analysis of variance designs, analysis of covariance, multivariate analysis, multiple regression, and analysis of categorical data. Emphasis on connecting research designs to appropriate statistical tests, data interpretation, and implementation in statistical packages. Consent of department required.
Prerequisites: PSYC 421

PSYC 423 (COGS 423) Foundations of Cognitive Science 3 Credits
Survey of fundamental theory and methodologies from artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience, as well as salient research problems such as knowledge acquisition and representation, natural language processing, skill acquisition, perception and action, and the philosophical question of intentionality.

PSYC 433 Cognitive Neuroscience Techniques 3 Credits
This glimpse into the toolkit of modern cognitive neuroscience provides an overview of a range of techniques from psychopharmacology and single cell recording, to human neuroimaging and neuropsychology. The course introduces different techniques with a focus on issues of temporal and spatial resolution, costs and benefits, and appropriateness for different research questions. Students will develop the skills to be knowledgeable consumers of the modern literatures in psychology and related fields that are increasingly incorporating a range of neuroscience methods.
Prerequisites: PSYC 403

PSYC 445 Prosocial and Moral Development 3 Credits
This course will explore children's prosocial and moral development (including the development of moral emotions, cognition, behavior, and values) in infancy through adolescence. In addition to exploring normative prosocial and moral development, we will also focus on the biological, social, and cultural factors that predict individual differences in prosocial and moral development.

PSYC 447 Understanding Evil, Understanding Morality 3 Credits
Cruelty, aggression, and mass killing are encountered all-too-frequently in human affairs. At the same time, most people feel allegiance to a "moral code," a code which invariably emphasizes kindness, compassion, non-violence, and even loving one's enemies. In this course, we will examine the psychological literature to see what insights it offers regarding these two perennial forces--Evil and Morality--that underlie human action.

PSYC 448 Seminar in Psychology of Language 3 Credits
Topics in language comprehension and production. Content will vary from year to year.
Prerequisites: PSYC 403

PSYC 450 Special Topics in Mathematical Models and Statistics 3 Credits
Selected topics in the application of mathematics to psychological research.
Repeat Status: Course may be repeated.

PSYC 457 (EVST 457) Psychology of Environmental Issues 3 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they perceive environmental risk and make decisions. We will also consider environmental communication and attitude and behavior change, exploring arenas ranging from patterns of consumption and recycling to climate change. Research methods for investigating these issues will be introduced.

PSYC 460 Special Study 1-9 Credits
Study of some special topic not covered in the regular course offerings.
Repeat Status: Course may be repeated.

PSYC 461 Research Seminar 1-9 Credits
Original research designed and executed in collaboration with the faculty.
Repeat Status: Course may be repeated.

PSYC 462 Stereotypes, Prejudice, Discrimination 3 Credits
An in-depth survey of the social psychological literature on stereotypes, prejudice, and discrimination. Topics will include: Origin of stereotypes, mental representation of stereotypes, cognitive and behavioral consequences of stereotypes, inevitability of stereotyping, nature of prejudice in contemporary American society, context-specificity of discriminatory behavior, and theories of intergroup conflict reduction.
Prerequisites: PSYC 406

PSYC 476 Seminar In Cognition 3 Credits
Selected topics in human information processing, including such areas as attention, memory, language and comprehension, and decision-making. Area of emphasis will vary from year to year.
Prerequisites: PSYC 403

PSYC 478 (COGS 478) Ontological Psychology 3 Credits
Principles and constraints for the modeling of psychological phenomena: Representation, perception, memory, knowing, emotions, consciousness, language, and rationality.

PSYC 480 Seminar in Cognitive Development 3 Credits
Selected topics in cognitive development in infancy and childhood, including such areas as conceptual development, memory development, the development of reasoning abilities, and language acquisition. Emphasis will vary from year to year.
Prerequisites: PSYC 402

PSYC 481 Selected Topics in Social and Personality Development 3 Credits
Topics include emotional and sex-role development, peer relations, and social competence. Emphasis will vary from year to year.
Prerequisites: PSYC 402

PSYC 482 Seminar In Adult Development 3 Credits
Application of lifespan developmental theory and methodology to personality, social, and cognitive development in adulthood.
Prerequisites: PSYC 402

PSYC 483 Seminar In Cultural Psychology 3 Credits
Major theoretical approaches and empirical debates in cultural psychology, with a focus on the interplay of individual and sociocultural elements in the formation of mind, the emergence of the self, and the definition and reproduction of culture.
Prerequisites: PSYC 402

PSYC 490 Thesis Research 1-6 Credits
Master's Thesis or Pre-dissertation Project research directed by committee.

PSYC 491 Special Topics 1-3 Credits
Intensive study of a topic of special interest not covered in other courses.
Repeat Status: Course may be repeated.

PSYC 499 Dissertation Research 1-15 Credits
Ph.D. dissertation research directed by dissertation committee.

Religion, Culture and Society

Department Home Page

The department of Religion, Culture and Society is committed to the academic investigation of religion as an intrinsic and vital dimension of human culture. The scholarly study of religion is an integral facet of a liberal arts education. Students engage in the critical and interpretive task of understanding patterns of religious thought and behavior as aspects of the human cultural experience.

Religion, Culture and Society is an interdisciplinary department that draws upon humanistic and social scientific modes of inquiry. These include historical, philosophical, sociological, anthropological, and psychological perspectives. The study of religion is a cross-cultural, comparative discipline concerned with the character and significance of the major religious traditions of the world. Students confront ethical problems and basic issues of value and meaning raised by modern multicultural and technological society.

MAJOR IN RELIGION, CULTURE AND SOCIETY

The major in Religion, Culture, and Society consists of 32 credit hours of coursework (eight courses). In consultation with a major advisor from the departmental faculty, students will devise a balanced plan of study responsive to individual needs and interests. The curriculum for each major will demonstrate exposure to a diversity of approaches to the interdisciplinary, trans-cultural field of religion studies. Requirements include:

Religion Studies Coursework Chosen in consulation with Major Advisor [1]		28
REL 374	Seminar for Majors	4
Total Credits		**32**

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At least four courses at the 100-level or above.

The department recommends that in consultation with a major advisor, students concentrate in one of the major religious traditions, or in a comparative or thematic approach to the study of religion. The concentration should include at least four courses. Language study appropriate to the concentration is also desirable.

Students are particularly encouraged to consider a joint or double major with another major field from any of the three colleges at the university.

DEPARTMENTAL HONORS

Religion, Culture and Society majors are admitted to honors by invitation of the departmental faculty toward the end of the student's junior year. To be eligible, a student must have attained at least a 3.25 average in his or her major program by the end of the fall semester in the junior year. Upon admittance to honors, the student will work out a special program of studies for the senior year with the major advisor, culminating in the writing of a senior essay.

MINOR IN RELIGION, CULTURE AND SOCIETY

The minor in Religion, Culture, and Society consists of a total of 16 credits. The specific courses to be taken by each student are to be decided upon jointly by the student and the departmental advisor. Ordinarily, the student will be expected to take one introductory course unless specifically exempted by the department chair.

Minor in Religion, Culture, and Society

Religion, Culture, and Society Coursework [1]	16

1

Coursework chosen in consultation with the departmental advisor.

Courses

REL 001 Sacred Scriptures in Religious Traditions 4 Credits
An encounter with the different sacred books of the world's major religions. Both the books and differing attitudes in these traditions towards sacred books are examined. Books investigated include the Bhagavad Gita, the Analects of Confucius, the Qur'an and the Jewish and Christian Bibles.
Attribute/Distribution: HE, HU

REL 002 (ETH 002, HMS 002) Death and Dying: Religious and Ethical Perspectives 4 Credits
Introduces students to the study of religion, world religious traditions and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.
Attribute/Distribution: HE, HU

REL 003 (ETH 003, PHIL 003) Global Religion, Global Ethics 4 Credits
Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally in and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, vengeance).
Attribute/Distribution: HE, HU

REL 005 Spiritual Exercises in Religious Traditions 4 Credits
Explores a variety of religious disciplines developed in various traditions, ranging from the practice of yoga and the martial arts to various forms of prayer, meditation, and asceticism.
Attribute/Distribution: HE, HU

REL 007 What Is Religion? 4 Credits
The word "religion" is fairly recent in origin, its linguistic roots unclear, and the phenomena that it has been used to designate both vast and amorphous. This course explores some of the most prominent attempts to define "religion," definitions produced both by religious thinkers and by critics of religion. We will examine some of the methods used by scholars to study religion. Finally, we will ask how the meaning of the word may be shifting in a modern, secular age.
Attribute/Distribution: HE, HU

REL 010 (ASIA 010, PHIL 010) Intro to Buddhism: Love Death and Freedom 4 Credits
This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism's Indian origins to its spread across Asia and globally. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and the forms of social and individual love and concern. Course materials include poetry, biographies, philosophical writings, art and film.
Attribute/Distribution: HE, HU

REL 011 (GS 011) Introduction to World Religions 4 Credits
Living and working in a globalizing 21st century requires an understanding of diverse religious and cultural identities. In this course, students will be introduced to the history, ideas, and practices from a wide variety of the world's religious traditions.
Attribute/Distribution: HE, HU

REL 012 (ASIA 012) Mountains, Buddhas, Ancestors: Introduction to East Asian Religions 4 Credits
This course explores the principal religions of East Asia, including Buddhism, Daoism, Confucianism, Shinto, and Shamanic Traditions. What is each tradition's view of human potential? How is ultimate reality depicted and experienced? What do home altars, boisterous festivals, and silent meditation halls have in common? Several primary texts are read in translation.
Attribute/Distribution: HE, HU

REL 013 (GS 013) Religion and Food 4 Credits
This course explores the complex connections between religion and food. We will examine food-related rituals, including Jewish Passover seders, Christian communion, and Hindu puja; the role of gastronomy in forming religious and ethnic identity; and the global ethics of food and sustainability. We will also probe the notion of food itself as sacred. Are "foodies" engaging in their own sort of sacred actions? How does food connect with the sublime? The class will include tastings and outings as scheduling permits.
Attribute/Distribution: CC, HE, HU

REL 014 "Virtual" Religion 4 Credits
The contemporary world is replete with social phenomena that resemble religious thought and practice – sports fandom, trekkies, nationalistic rituals, online gaming, military camaraderie and codes, environmental activism, etc. In this course we will explore and discuss many of these "virtually" religious phenomena through the lens of the study of religion.
Attribute/Distribution: CC, HE, HU, W

REL 015 Engineering the Impossible 4 Credits
Good intentions do not always lead to good results. Engineering the Impossible turns to religious studies to think through the most amazing technological successes and the social, ecological, and economic costs associated with scientifically and technologically engineering the impossible. Topics include the technological singularity, internet privacy, eugenics, and cutting-edge military research and development, this course is for anyone who might ever have to ask the question: "Sure, we can make that happen, but should we?".
Attribute/Distribution: HU

REL 025 (AAS 025) Introduction to Black Religions and Hip-Hop 4 Credits
Rapper KRS ONE once stated that, "Rap is something you do and Hip-Hop is something you live." This course thinks through the global evolution of Hip-Hop culture and the public and academic study of Black Religions as responses to structural and historical inequality and the search for meaning in culture by considering themes of resistance, constraint, power, the body, deviance, and morality over and against race, class, gender, and sexuality from a range of academic and cultural sources.
Attribute/Distribution: HU

REL 030 (JST 030) Beyond Bagels: Jews and Food 4 Credits
What does Crisco have to do with Jewish history? What is eco-kashrut? And why do so many Jews eat Chinese food on Christmas? This course explores Jewish life through the diverse history of Jewish foods. From New York deli to matzah ball gumbo, we will dig into a rich stew of diverse Jewish practices, regions, genders, ethics, and rituals.
Attribute/Distribution: CC, HE, HU

REL 032 Religion of Disney 4 Credits
In its vast scope, power, various forms of consumer products, and enormous intellectual property holdings (including Star Wars and the Marvel Cinematic Universe, as well as its recent acquisition of 20th Century Fox), the Walt Disney Company has tremendous influence over modern American--and global--society. This course uses the rubric of "religion" to investigate both the fan culture surrounding Disney and its many properties, and the company's corporate aspirations, structure and ethos.
Attribute/Distribution: CC, HE, HU

REL 036 (WGSS 036) New Black Godz 4 Credits
From celebrity self-defining agents of material abundance (Jay Z) to those posthumously made gods after tragically succumbing to socially-sanctioned sacrifice (Breonna Taylor), “New Black Godz” explores black icons at the center and margins of promise and peril. Following hip hop and black expressive cultures’ signifying on gods, we explore means/modes of black godz’ creative manipulation of identity and social difference, and ingenuity of transmuting “problem” status into creative ingenuity at the crossroads of social mobility and the limits of escape.
Attribute/Distribution: HU

REL 040 (PHIL 040) Is God Dead? Past, Present, Future 4 Credits
Is God Dead? Some people think so. Do you? Come decide for yourself. This course looks at the idea of god in Western philosophy and theology, with particular attention to death of god movement(s), and the changing shape of these movements in light of culture wars and identity politics. The course surveys key thinkers to ask questions about the origins, functions, and future of god and gods in the contemporary world. Posed as an ongoing question-Is god dead?
Attribute/Distribution: HU

REL 044 (GS 044) Religious Fundamentalism in Global Perspective 4 Credits
This course will explore the rise of fundamentalist religious movements and their involvement in violent conflicts. Topics to be considered will include the relationship between fundamentalist religious ideologies and terrorism, and the kinds of responses that fundamentalist religious movements present to the development of a global marketplace and the spread of secular nationalisms.
Attribute/Distribution: CC, HE, HU

REL 060 (ASIA 060) Religions of South Asia 4 Credits
A thematic introduction to the foundational religious traditions of South Asia: Hinduism, Jainism, Buddhism, Sikhism and Islam. Students explore the social and spiritual dimensions of these religious worlds through scripture, ritual practices, narrative and teaching traditions, music and art.
Attribute/Distribution: HE, HU

REL 066 Religion and the Paranormal 4 Credits
UFOs. Cattle Mutilations. Demonic Possession. Telepathy. Is any of this stuff real? What does real mean, anyway? Ask an "experiencer" and the answer is surely yes, but ask a skeptic and it is all make believe. Following weekly case-studies, students will leave the class with the ability to critically compare various beliefs, and with awareness of the relationship between experience, belief, and what we know about the world.
Attribute/Distribution: HU

REL 070 (JST 070) Antisemitism Past and Present 4 Credits
As a ubiquitously present minority in western Christian societies over time, Jews have served as a foil for western identities in ways that continue to resonate in the modern and contemporary contexts. This course will consider the role that anti-Judaism and antisemitism have played in western culture from the ancient period to the present day.
Attribute/Distribution: CC, HE, HU

REL 073 (JST 073) The Jewish Tradition 4 Credits
Judaism is both a textual tradition and a lived religion. Students read basic Jewish texts—Bible, Talmud, Midrash—and study the ways Jews sanctify the life cycle through rites of passage, and the round of the year through the festival cycle.
Attribute/Distribution: HE, HU

REL 075 The Christian Tradition 4 Credits
Introduction to the Christian tradition from its early variety and subsequent classical definition in the church councils up to the enlightenment. Special emphasis will be placed on the multiform interpretations of the Christian message.
Attribute/Distribution: HE, HU

REL 077 (ASIA 077, GS 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur’an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.
Attribute/Distribution: HE, HU, W

REL 079 Religion and Fantasy Literature 4 Credits
A survey of the religious themes that entered fantasy literature in the 1950s in the works of C. S. Lewis and J. R. R. Tolkien, and the humanist resistance to those themes in works by J. K. Rowling, Philip Pullman, or others.
Attribute/Distribution: HE, HU, W

REL 080 Religion and Violence 4 Credits
In this course we will explore the relationship between religious ideology with acts of violence. By examining a wide range of different instances of religious violence among Christians, Jews and Muslims, along with their accompanying ideologies, we will consider the relationship between religious affiliation, communally shared modes of discourse, and violent conflict.
Attribute/Distribution: CC, HE, HU

REL 081 (JST 081) Jewish Mysticism 4 Credits
This course will examine both the history and the central texts and ideas of the Jewish mystical tradition. We will read a broad range of texts, including the ancient Sefer Yetzirah or Book of Creation, the Zohar, the works of Isaac Luria and his disciples, and the writings of some of the 18th and 19th century Hasidic rabbis. We will also explore the contemporary emergence of Kabbalah and the activities of the Kabbalah Center in contemporary America.
Attribute/Distribution: HE, HU

REL 088 Religion and Science Fiction 4 Credits
This course explores major concepts in religion studies through science fiction literature, television, and film. Themes to be covered include (but are not limited to): Utopias/Dystopias, Artificial Intelligence, Virtual Reality, Alternative Worlds, Human and PostHuman Futures, God and Technology. Our investigation of these themes will rely on a wide variety of sources designed to enlighten and illustrate the many different ways both religion and SciFi deal with questions of meaning, identity and the nature of reality.
Attribute/Distribution: CC, HE, HU, W

REL 091 Special Topics 1-4 Credits
Study of a subject not covered by regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, W

REL 099 Special Topics 1-4 Credits
Repeat Status: Course may be repeated.

REL 102 (AAS 102, ENGL 102, JST 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: CC, HE, HU, W

REL 106 (ETH 106, HMS 106, PHIL 106) Bioethics and the Law 4 Credits
Students in this course will learn something about the foundations and (nontechnical) workings of the American system of justice, and will combine that understanding with a focus on various topics in bioethics, from the "right to die" to gene-patenting. A key point will be the understanding that, as science and medicine continually move forward, there are always new challenges to existing legal understanding. How should the law respond to new questions, e.g. inheritance rights of posthumously conceived children?
Attribute/Distribution: HU

REL 107 (HMS 107, PHIL 107) Bio-Ethics and the Family 4 Credits
From reproduction to dying, this course will focus on how ethical issues in science and medicine highlight the role of the family. Issues include assisted reproduction and the role of gamete donors; genetic testing and the problem of misattributed paternity; the locus of decision making when patients are terminal or in pvs. Should our individual-orientated medical culture move toward a more family-oriented perspective?
Attribute/Distribution: HU

REL 110 (ASIA 110, MLL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined.
Attribute/Distribution: HE, HU, W

REL 111 (JST 111) Jewish Scriptures/Old Testament 4 Credits
The religious expression of the Hebrews, Israelites, and Jews as found in the Jewish Scriptures (TANAK/Christian Old Testament). Near Eastern context of Hebrew religion, the Patriarchs, the Exodus, the monarchy, prophecy, Exile and Return. Emphasis on historical, literary, critical problems, and newer socio-historical methods.
Attribute/Distribution: HE, HU, W

REL 112 (JST 112) The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World 4 Credits
The variety of approaches to Judaism in the period following the Babylonian exile through the second century C.E. The literature studied will include Apocrypha, Pseudepigrapha, and the Dead Sea Scrolls.
Attribute/Distribution: HE, HU, W

REL 114 (CLSS 114, JST 114) Christian Origins: New Testament and the Beginnings of Christianity 4 Credits
Early Christianity from its beginnings until the end of the second century. Coverage includes the Jewish and Hellenistic matrices of Christianity, traditions about the life of Jesus and his significance, and the variety of belief and practice of early Christians. Emphasis on encountering primary texts.
Attribute/Distribution: HE, HU, W

REL 115 (PSYC 115) Religion And Psychology 4 Credits
A study of the origins, development and consequences of religion from a psychological perspective. Attention will be given to classic and contemporary sources, with a focus on major psychoanalytic theorists of religion (Freud, Jung, Erikson); psychological analyses of religious experience (e.g., Wm. James, Victor Frankl); and the diverse cultural and religious forms that structure the connection between religion and psychology (e.g., Buddhist psychology, Japanese Morita therapy).
Attribute/Distribution: HE, HU

REL 116 (ETH 116, HMS 116, PHIL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: CC, HE, HU

REL 119 (ASIA 119, GS 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a "modern" religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.
Attribute/Distribution: CC, HE, HU, W

REL 121 (JST 121) Sources for the Life of Jesus: the Jewish and Christian Context 4 Credits
Ancient sources that claim to provide information about Jesus of Nazareth. Approaches taken to Jesus' life and career; early Christian interpretations of the significance of Jesus; methodology in assessing evidence for the historical Jesus and his message.
Attribute/Distribution: HE, HU, W

REL 122 (JST 122) Archaeology and the Bible 4 Credits
In this course we will examine the way that archaeological work can inform the study of the Bible. One important consideration is how archaeological data have been used either to confirm or falsify the biblical texts. We will look at how archaeologists work and how archaeological data and the Bible intersect. We will examine in detail several archaeological sites in order to understand better the difficulties in interpreting the material remains that archaeologists dig up.
Attribute/Distribution: HE, HU, W

REL 123 (JST 123) Armaggedon: Endtime Thinking in Judaism and Christianity 4 Credits
Thinking about how the world will end was an important feature of certain types of ancient Judaism. Early Christianity took over many of these ideas, and they became fundamental to later Christian theologies, including many that continue to be advocated today. This course will look at ancient Jewish and Christian texts that speak about the end of the world and will trace some of them through more contemporary developments in these two religious traditions.
Attribute/Distribution: HE, HU, W

REL 124 (PHIL 124) Philosophy Of Religion 4 Credits
A critical look, from a philosophical perspective, at some fundamental problems of religion: The nature of religious experience and belief, reason and revelation, the existence and nature of God, the problem of evil, and religious truth.
Attribute/Distribution: CC, HE, HU, W

REL 125 Comparative Religious Ethics 4 Credits
How have thinkers within the three major Abrahamic traditions handled ethical questions and dilemmas throughout history? This course will focus on many issues including but not limited to violence and pacifism, debates concerning revelation versus reason, the different accounts of justice and peace, the nature of scripture and the divine. We will look comparatively both within and across these traditions.
Attribute/Distribution: CC, HE, HU, W

REL 126 (POLS 126) Religion, Law and Constitution 4 Credits
An examination of the relationship of religion to American law and the United States Constitution. Course will focus on Supreme Court decisions involving the "establishment" and "free exercise" clauses of the First Amendment. Attention will also be given to the intellectual, historical, religious and theological background behind the American experiment in "church-state" separation, including the thought of Roger Williams, the Founders (Washington, Jefferson, Madison), and contemporary analysts (e.g., M. Nussbaum).
Attribute/Distribution: CC, HU, SW

REL 129 (JST 129, PHIL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HE, HU, W

REL 130 (ASIA 130, MLL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment odyssey, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HE, HU, W

REL 138 (JST 138, WGSS 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women's memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children's literature, among others.
Attribute/Distribution: CC, HE, HU, W

REL 140 (GS 140) Globalization and Religion 4 Credits
This course examines the complexity of globalization and its multi-layered impact on religious identity and piety. Though comparative in methodology and historical framework, the class will give special attention to Islam and Hinduism in South Asia. Topics include: European colonialism; Orientalism and its legacy; religious nationalism; Islamophobia; and the Internet and mass media.
Attribute/Distribution: CC, HE, HU, W

REL 141 (PHIL 141) Islamic Philosophy 4 Credits
The medieval era was the golden age of Islamic civilization. Science, mathematics, theology, philosophy, logic, jurisprudence, and many other disciplines flourished during that time. The course is an introduction to medieval Islamic philosophy. There is no indigenous Islamic philosophy other than medieval Islamic philosophy and theology, and commentaries on and interpretations of medieval Islamic philosophical and theological texts. The readings cover selections from the writings of al-Kind#, al-R#z#, al-F#r#b#, Ibn S#n# (Avicenna), al-Ghaz#l#, Ibn #ufayl, and Ibn Rushd (Averroes).
Attribute/Distribution: HE, HU

REL 143 (GS 143) Religious Nationalism in a Global Perspective 4 Credits
Religion has become a renewed political force on the world stage in recent years. This course will focus on how religion has often provided both the Ideological language and the organizing principles for many modern nationalisms. Our exploration of this topic will take the form of case studies from various parts of the world, including but not limited to Pakistan, Israel, No. Ireland, India, Iran and USA.
Attribute/Distribution: CC, HU, SW, W

REL 145 (ASIA 145, GS 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the changes and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: CC, HE, HU, W

REL 148 (GS 148) Islam Across Cultures 4 Credits
Explores the Muslim world's diversity and dynamism in multiple cultural contests-from the Middle East and North Africa, to Asia and America-through literature, ethnography, and films. Topics include: travel and trade networks; education; women and gender; Islam and cultural pluralism; colonialism; and identity politics.
Attribute/Distribution: CC, HE, HU, W

REL 149 (ETH 149) Modern Islamic Ethics 4 Credits
This course will focus on developments in Islamic thinking and ethics that emerge from the modern encounter between Muslim societies and the West. We will discuss Islamic modernism and fundamentalism through short primary texts from a variety of modern Muslim thinkers.
Attribute/Distribution: CC, HE, HU, W

REL 151 (HMS 151, JST 151, PHIL 151) Judaism, Medicine, and Bioethics 4 Credits
This class traces the relationship between Jews and medicine from 1100 to 2020. How does Jewish religion and culture cultivate an affinity for the healing arts? How does Jewish law, ethics, and culture inform contemporary bioethics?
Attribute/Distribution: HE, HU

REL 152 (JST 152) American Judaism 4 Credits
Diverse cultural and social forms through which American Jews express their distinct identity. Is American Jewry an example of assimilation and decline or creative transformation? What, if anything, do American Jews share in common? Compatibility of Judaism with individualism, pluralism, and voluntarism. How have the Holocaust and the State of Israel shaped the self-understanding of American Jewry?
Attribute/Distribution: HE, HU, W

REL 154 (HIST 154, JST 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust.
Attribute/Distribution: CC, HE, HU, W

REL 156 (JST 156) Judaism and Comic Books 4 Credits
Is The Thing Jewish? What does Superman have to do with the bible? Do Orthodox Jewish girls fight trolls? In this course, we will closely examine comic books and graphic novels in order to expand our understanding of what Jewishness might mean. With a POW! and a BAM!, we will consider many topics "from Krakow to Krypton," including American Jewish history, how representations of Jews are gendered, global Jewish traditions, monsters and mutations, biblical adaptations, and more!
Attribute/Distribution: HE, HU, W

REL 159 Roman Catholicism in the Modern World 4 Credits
A survey of the various intellectual, cultural, political and ecclesiastical developments that have shaped contemporary Roman Catholic life and thought.
Attribute/Distribution: HE, HU

REL 161 (GS 161, JST 161) Globalization in the Ancient Mediterranean 4 Credits
We often think of globalization as a modern phenomenon. Yet as early as the twelfth century BCE, transportation, trade, political and religious networks tied the Mediterranean basin together. This course will examine in three periods-the Late Bronze Age, the Hellenistic period, and the Roman period-how these networks were organized and how they affected a range of Mediterranean and Near Eastern peoples. We will use some modern approaches to globalization as analytical tools for understanding the ancient world.
Attribute/Distribution: HE, HU, W

REL 169 (ASIA 169) Enlightening Lives: Buddhist Auto/Biography in Asia and the US 4 Credits
How do Buddhists imagine a "good life"? Buddhist biographies, autobiographies, poems, paintings, and films from Asia and the US reveal how Buddhists describe an ideal human life, addressing love, art, war, religious awakening.
Attribute/Distribution: CC, HE, HU, W

REL 171 (SOC 171) Religion And Society 4 Credits
An introduction to the sociology of religion. Covers classical and contemporary approaches to defining and studying the role of religion in society. Emphasis on understanding religious beliefs and practices in the United States, the sources and contours of religious change, and the effects of religion on individuals and society. Specific topics include religious fundamentalism, religious conversion, religious practices and authority, secularization, religion in public life, religion in social change, religious terrorism, and the ways in which religion impacts our personal health, educational attainment, and family life.
Attribute/Distribution: CC, SS, SW

REL 172 (ASIA 172) Tibetan Buddhism and Society 4 Credits
This course examines the history, rituals, practices and art of the Tibetan Buddhist world, and the interaction of Tibetan Buddhism with the Tibetan Bon religion and Tibetan Islam. Students will explore film, autobiography, visual arts, and religious writings, asking, How has Tibetan Buddhism shaped Tibetan societies, as well as neighboring cultures in East Asia and Inner Asia? In what ways is Tibetan Buddhism now a global religion?
Attribute/Distribution: HE, HU, W

REL 173 (ASIA 173, WGSS 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S..
Attribute/Distribution: CC, HE, HU, W

REL 174 (JST 174) Modern Theology 4 Credits
Major 20th century movements within Christian and Jewish theology understood as responses to the problems of modern times.
Attribute/Distribution: HE, HU, W

REL 175 (GS 175, HIST 175, JST 175) History of Racism, anti-Semitism, and Islamophobia 4 Credits
From the history of slavery in the ancient world to Charlottesville 2017. We will read texts and watch movies that discuss the history of slavery, anti-Semitism, and Islamophobia. The historical meeting of worlds goes from "social slavery" in the ancient world to the "blood laws" in medieval Spain; colonialism in the New World, the rise of biological racism in the nineteenth century, and of cultural racism in the twentieth century.
Attribute/Distribution: CC, HE, SS, W

REL 177 (JST 177, THTR 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels-as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HE, HU, W

REL 180 (HIST 180) Religion and the American Experience 4 Credits
The historical development of major religious groups in this country from colonial times to the present.Their place in social and political life, and the impact of the national experience upon them.Emphasis on religious freedom and pluralism, and the churchstate relationship.
Attribute/Distribution: HE, HU, W

REL 187 Science, Technology, and the Religious Imagination 4 Credits
Impact of the scientific and technological culture on the Western religious imagination. Roots of science and technology in religious ideas and images. Ways of knowing and concepts of experience in religion and science.
Attribute/Distribution: CC, HE, HU, W

REL 188 Religion and Literature 4 Credits
Religious themes in the modern novel or the spiritual autobiography. Melville, Tolstoy, Camus, Updike, Walker, and Morrison; or Woolman, Tolstoy, Malcolm X, Wiesel, Frederick Douglass, Sojourner Truth, Kukai.
Attribute/Distribution: HE, HU

REL 191 Special Topics 1-4 Credits
Study of a subject not covered by regular catalog courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

REL 216 (ETH 216, HMS 216, PHIL 216) Research Ethics 4 Credits
Research with human and animal subjects carries with it a host of ethical and legal obligations. Topics include the history of human subjects research; ethical use of placebo studies; the ethics of research in developing countries; whether there is an ethical obligation to volunteer to be a research subject.
Attribute/Distribution: HU

REL 220 (ASIA 220) Poet, Meditator, King: Classics of East Asian Religion 4 Credits
Classic texts of East Asia and an introduction to the traditions they represent. What do these texts teach about reality, humanity, divinity, virtue and society? How is the path of personal and social transformation presented?
Attribute/Distribution: HU

REL 221 (ASIA 221) Topics in Asian Religions 4 Credits
Selected thematic and comparative issues in different Asian religious traditions. May include Buddhism and Christianity, religion and martial arts, Asian religions in America, Taoist meditation, Zen and Japanese business, Buddhist ethics. (H/S).
Repeat Status: Course may be repeated.

REL 222 Topics In Western Religions 4 Credits
Selected historical, thematic, and comparative issues in Judaism, Christianity, and Islam.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

REL 224 (PHIL 224) Topics in the Philosophy of Religion 4 Credits
Selected problems and issues in the philosophy of religion. Student must have completed at least one Philosophy course at the 100-level.
Attribute/Distribution: CC, HU, W

REL 225 Topics in Religion and Ethics 4 Credits
Analysis of various moral problems and social value questions. Possible topics include: environmental and non-human animal ethics; medical ethics; drug and alcohol abuse; spiritual meaning of anorexia.
Attribute/Distribution: HU

REL 226 (ETH 226, HMS 226) From Black Death to Covid-19:Plague,Pandemic,Ethics and Religion 4 Credits
An investigation into the ways religion and morality shape interpretations of plague and pandemics. Three specific pandemics are examined: the bubonic plague of the 14th century, the 1918 Spanish Flu pandemic, and the current global Covid-19 crisis. Moral issues provoked by institutional, political and social responses to pandemic disease are also considered.
Attribute/Distribution: HE, HU, W

REL 228 Theories Of Religion 4 Credits
What is religion? Does it have a universal, cross-cultural and trans-creedal essence? Drawing on numerous academic disciples, the course engages the major issues and most influential authors in the academic study of comparative religions.
Attribute/Distribution: HE, HU

REL 247 (ASIA 247, GS 247) Islamic Mysticism 4 Credits
Sufism, the inner or ‘mystical’ dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition’s impact on art and music, poetry and prose.
Attribute/Distribution: CC, HE, HU, W

REL 254 (ASIA 254, ETH 254, EVST 254) Buddhism and Ecology 4 Credits
Buddhism’s intellectual, ethical, and spiritual resources are re-examined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: CC, HE, HU, W

REL 300 Apprentice Teaching 1-4 Credits

REL 317 (ENGL 317) Topics in Jewish Literature 3-4 Credits
Selected topics in Jewish literature, which may include: Contemporary Jewish Literature, Philip Roth's Complaint, and Jewish Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

REL 335 (ANTH 335) Religion, Witchcraft And Magic 4 Credits
Addresses broad questions about supernatural beliefs as systems of meaning and as practical and moral guides, with a focus on theoretical explanations for supernatural beliefs and the function of religious specialists in the social organization of cultures.
Attribute/Distribution: CC, SS, SW

REL 347 (PHIL 347) American Religious Thinkers 3-4 Credits
An examination of the writings of key figures in the history of American religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to the historical reception of these writings and to their contemporary significance.
Attribute/Distribution: HU, W

REL 350 Religion and Politics in Comparative Perspective 4 Credits
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.
Attribute/Distribution: CC, SS, SW, W

REL 361 Fieldwork 1-4 Credits
Opportunity for students to work, or observe under supervision, religious organizations or institutions. Consent of chair required.
Attribute/Distribution: CC, W

REL 371 Directed Readings 1-4 Credits
Intensive study in areas appropriate to the interests and needs of students and staff.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

REL 374 Seminar for Majors 4 Credits
A capstone seminar for departmental majors. Considers the methodologies of religious studies and assesses current issues in the field. Offers opportunities for in-depth work on a particular tradition under the guidance of a faculty member. Offered in spring semester.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, W

REL 375 (SOC 375) The Christian Right In America 4 Credits
What do we know about the Christian Right? Who are they? What do they believe? Where do they come from? Seminar explores answers to such questions through a focus on the history of the Christian Right as well as its ideologies and beliefs, the people who are a part of it, and its evolving relationship to the American political system.
Attribute/Distribution: CC, SS, SW, W

REL 389 Honors Project for Eckardt Scholars 1-8 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. May be repeated for credit up to a maximum 12 credit hours. Transcript will identify department in which project was completed. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

REL 391 Senior Thesis in Religion 4 Credits
Opportunity for undergraduate majors in Religion Studies to pursue an honors thesis. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

Sociology and Anthropology

Web site: http://socanthro.cas2.lehigh.edu/. The department is home to sociology and anthropology. Sociology is the study of human beings in relationships with others. Anthropology is the holistic study of humans today and in the past, in a global, comparative, and multicultural perspective. Together, these disciplines encompass the broadest range of human activities, from comparative examination of diverse past and present cultures and societies, to the influence of society on individual behavior, to examination of the most pressing social issues of our time and what it means to be human.

The curricula within the department provide students with skills necessary to understand and conduct social research in a variety of employment settings through training in research design, methods, and data analysis. Students acquire a theoretical background that promotes self and societal awareness that are valued by a wide range of prospective employers.

The department offers three bachelor of arts majors: Anthropology, Sociology, and Sociology and Anthropology. The three programs are parallel in structure and requirements and each consists of 40 credit hours of course work. The Sociology and Anthropology major is an interdisciplinary program for students desiring a broader social science perspective, whereas the Anthropology and Sociology majors are for students desiring more focused, disciplinary programs of study.

Research Opportunities

The department supports students in research of their own design, as well as engaging students in ongoing research activities of faculty members. Second semester sophomore, junior and senior students interested in a supervised research experience are encouraged to consult with the chair or appropriate faculty member. Course credit can be received for research experience.
Explore our faculty and their areas of research interest at our website: https://socanthro.cas.lehigh.edu/faculty-staff (https://socanthro.cas.lehigh.edu/faculty-staff/). Learn more about research opportunities here: https://socanthro.cas.lehigh.edu/student-research (https://socanthro.cas.lehigh.edu/student-research/).

Internship Opportunities

The department maintains close working relationships with a variety of social agencies and institutions in the area. Majors can earn course credit by carrying out supervised work in field settings—see https://socanthro.cas.lehigh.edu/internship-opportunities (https://socanthro.cas.lehigh.edu/internship-opportunities/) for more details. This experience allows a student to apply the concepts learned in the classroom to potential employment settings and to evaluate professional options.

Senior Thesis

Majors are encouraged to do independent research culminating in a senior thesis; this is especially recommended for students intending to go on to graduate or professional school. The junior year is the time to begin discussing possible projects with faculty. The department chairperson should be consulted for further details. Our web site has additional information. More information is available at https://socanthro.cas.lehigh.edu/senior-theses (https://socanthro.cas.lehigh.edu/senior-theses/)

Departmental Honors

To be eligible for departmental honors, students must have at least a 3.5 GPA in the major. In addition, students pursuing honors must register for ANTH or SOC 399 and write a thesis during their senior year. Awarding of departmental honors is contingent on both the quality of the thesis, as judged by a department committee, and the candidate's GPA at time of graduation.

B.A. Major Programs

ANTHROPOLOGY

Introductory		**8**
ANTH 011	Cultural Diversity and Human Nature	
ANTH 012	Intro to Archaeology and Human Origins	
Theory		**4**
Select one of the following courses in anthropology theory:		
ANTH 213	Culture Theory	
ANTH 227	Archaeological Theory	
SOC 212	Development of Social Theory	
ENGL 309	Interpretation: Critical Theory and Practice	
Methodology		**4**
Select one of the following methodology courses:		
ANTH 212	Doing Archaeology	
ANTH 214	How to Study Culture	

ANTH 215	Field School
SOC 211	Research Methods and Data Analysis
Major Electives	**20**
Select five anthropology courses: [1]	
Research, Internship, or Thesis	**4**
Select one of the following: [2]	
ANTH 300	Apprentice Teaching
ANTH 393	Supervised Research
ANTH 395	Internship
ANTH 399	Senior Thesis [3]
Total Credits	**40**

1

At least two of which must be at the 300-level. Individualized study courses ANTH 300, ANTH 393, ANTH 395, and ANTH 399 cannot be used to fulfill this requirement; however, one SOC course can be substituted as an anthropology elective.

2

Preferably during the senior year, majors must complete at least four credits of experiential learning on a subject or in a context relevant to their major. Students may fulfill this requirement in a variety of ways - research, apprentice teaching, internship or thesis.

3

Students who intend going on to graduate or professional school are strongly encouraged to do the senior thesis option, and a senior thesis is required for departmental honors.

SOCIOLOGY AND ANTHROPOLOGY

Collateral Requirement	**3-4**
Select one the following general courses in statistics:	
ECO 045	Statistical Methods
MATH 012	Basic Statistics and Data Science [1]
SOC 012	Statistics for Understanding the Social World
Or equivalent	
Introductory	**8**
SOC 001	Introduction to Sociology
ANTH 011	Cultural Diversity and Human Nature
Theory	**4**
Choose one of the following:	
ANTH 213	Culture Theory
SOC 212	Development of Social Theory
Methodology	**8**
Select two of the following:	
ANTH 212	Doing Archaeology
ANTH 214	How to Study Culture
SOC 211	Research Methods and Data Analysis (Fall)
SOC 221	Qualitative Methods
SOC 222	Introduction to Survey Research
SOC 223	It's Who You Know: Understanding Social Networks
SOC 226	Computational Text Analysis
SOC 229	Data Visualization in the Social Sciences
Major Electives	**16**
Select two courses in sociology [2,3]	
Select two courses in anthropology [2,4]	
Total Credits	**39-40**

1

Note: MATH 012 fulfills the College of Arts and Sciences' mathematics requirement.

2

One of which must be at the 300-level.

3

Individualized study courses SOC 300, SOC 393, SOC 395, and SOC 399 can be taken as major electives but cannot be used to fulfill the 300 level course requirement.

4

Individualized study courses ANTH 300, ANTH 393, ANTH 395, and ANTH 399 can be taken as major electives but cannot be used to fulfill the 300 level course requirement.

SOCIOLOGY

Collateral Requirement	**3-4**
Select one of the following general courses in statistics:	
MATH 012	Basic Statistics and Data Science [1]
ECO 045	Statistical Methods
SOC 012	Statistics for Understanding the Social World
Or equivalent	
Introductory	**4**
SOC 001	Introduction to Sociology
Theory	**4**
SOC 212	Development of Social Theory
Methodology	**8**
SOC 211	Research Methods and Data Analysis (Fall)
And one of the following:	
SOC 221	Qualitative Methods
SOC 222	Introduction to Survey Research
SOC 223	It's Who You Know: Understanding Social Networks
SOC 226	Computational Text Analysis
SOC 229	Data Visualization in the Social Sciences
ANTH 214	How to Study Culture
Major Electives	**16**
Select four courses in sociology: [2]	
Research, Internship, or Thesis	**4**
Select one of the following: [3]	
SOC 300	Apprentice Teaching
SOC 393	Supervised Research
SOC 395	Internship
SOC 399	Senior Thesis
Total Credits	**39-40**

1

Note: MATH 012 fulfills the College of Arts and Sciences' mathematics requirement.

2

At least two of which must be at the 300-level. Individualized study courses SOC 300, SOC 393, SOC 395 and SOC 399 cannot be used to fulfill this requirement; however, one ANTH course can be substituted as a "sociology" elective.

3

Preferably during the senior year, majors must complete at least four credits of experiential learning on a subject or in a context relevant to their major.

4

Students who go on to graduate or professional school are strongly encouraged to do the senior thesis option, and a senior thesis is required for departmental honors.

Minor Programs

ANTHROPOLOGY

ANTH 011	Cultural Diversity and Human Nature	4
or ANTH 012	Intro to Archaeology and Human Origins	
Select any four courses in Anthropology		16
Total Credits		**20**

SOCIOLOGY AND ANTHROPOLOGY

One of the following introductory courses:		4
SOC 001	Introduction to Sociology	
ANTH 011	Cultural Diversity and Human Nature	
ANTH 012	Intro to Archaeology and Human Origins	
Select two additional courses in Sociology at the 100 level or above		8
Select two additional courses in Anthropology at the 100 level or above		8
Total Credits		**20**

SOCIOLOGY

SOC 001	Introduction to Sociology	4
Select any four courses in Sociology		16
Total Credits		**20**

Anthropology Courses

ANTH 011 Cultural Diversity and Human Nature 4 Credits
A cross-cultural investigation of variation in human societies. Examines forms of social organization, kinship, religion, symbolism, and language through the consideration of specific cultural case studies in local and global contexts. Students will learn how anthropological research methods enhance understanding of contemporary social issues, help solve real-world problems, and foster an informed perspective on what it means to be human.
Attribute/Distribution: CC, SS, SW

ANTH 012 Intro to Archaeology and Human Origins 4 Credits
Explore how archaeologists and biological anthropologists scientifically study human evolution and how diverse human societies arose. Examine theories and evidence showing what makes both species and cultures adapt and change. Specific topics include: genetics; natural selection; primate behavior; dating and excavation methods; beginnings of art, agriculture, and inequality; and how researchers respond to racist and pseudoscientific claims about the past. Use data from archaeology, biology, and geology to support evidence-based explanations for what forces have made us human.
Attribute/Distribution: CC, NS, NW, Q

ANTH 091 Special Topics 4 Credits
Special topics in anthropology.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, SW, W

ANTH 100 Seminar in Anthropology 1-4 Credits
Topics in anthropology.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 106 (GS 106) Cultural Studies and Globalization 4 Credits
This course closely examines the complex relationship between culture and globalization. The impact of globalization on local culture is an essential topic. But the interaction of globalization and culture is not a one-way process. People around the world adapt globalization to their own uses, merging global cultural flows with local practices in transformative ways. The course will study the interaction of local culture with globalizing forces; immigration and culture; the localizing of mass culture; cultures of diasporic and migratory groups,.
Attribute/Distribution: CC, SS, SW, W

ANTH 108 (GS 108) Not-so-Lonely Planet: The Anthropology of Tourism 4 Credits
Love to travel? This course explores tourist attractions around the world to understand why people leave home, why they visit resorts, monuments, historical sites, memorials, parks, museums, and more. By reading anthropological scholarship and by visiting nearby attractions ourselves, we examine the politics and economics of the global tourism industry, the impact of tourism on local communities, and tourists' search for an 'authentic' experience. And we see how Disneyworld, of all places, provides insight into each of these topics.
Attribute/Distribution: CC, SS, SW, W

ANTH 117 (GS 117, LAS 117) Archaeology of Latin America 4 Credits
Explores the past of Latin America and the major civilizations that existed prior to European arrival and colonization. Extending from Mesoamerica through the Southern Andes, topics covered include the monumental structures, belief systems, and trade networks that made sure an entire continent was interconnected for millennia. This course also looks at the ways in which European colonialism has shaped the perception of these civilizations and how modern pseudoarchaeology continues to deny the accomplishments of indigenous cultures.
Attribute/Distribution: CC, SS, SW, W

ANTH 118 The Science of Archaeology 4 Credits
Hands-on course, with separate lecture and lab components, in which you will practice the technologies and tools used in the scientific approach to archaeology. This course provides an overview of the chemistry, physics, and geology that inform an archaeologists' understanding of the past and the ways in which the data collected from these tools can be interpreted through our knowledge of humanity at each step of the archaeological process. Concludes with a student project involving one of the tools covered.
Attribute/Distribution: NS, NW, Q, W

ANTH 121 (EVST 121) Environment and Culture 4 Credits
Impact of environment upon cultural variability and change. Comparative study of modern and past cultures and their environments as well as current theories of human/ environmental interaction.
Attribute/Distribution: CC, SS, SW, W

ANTH 126 (GS 126) Urban Anthropology 4 Credits
When you think of anthropology, you probably picture exotic fieldsites: the Arctic, the Amazonian rainforests, the beaches of the South Pacific. But contemporary anthropologists are just as likely to study Tokyo, Berlin, or Bethlehem, PA. This course examines anthropology both in and of the city. How have anthropologists thought about the complexities of urban life? How can anthropology help us make sense of urban governance? What does belonging mean in a city that is racially or ethnically diverse?
Attribute/Distribution: CC, SS, SW, W

ANTH 140 (COGS 140, MLL 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail.
Attribute/Distribution: SS, SW

ANTH 145 Human Evolution 4 Credits
Principles of biological anthropology focusing on the evolution of the human species. Topics include evolutionary theory, nonhuman primate diversity and behavior, the relationship between biology and behavior in evolutionary terms, the hominid fossil record, and genetic variability among contemporary human populations.
Attribute/Distribution: NS, NW, Q, W

ANTH 155 (GS 155, HMS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will learn how social and cultural factors shape health outcomes in a variety of human contexts, and will study culturally specific approaches to healing, including Western bio-medicine. The course offers a broad understanding of the relationship between culture, health, and healing.
Attribute/Distribution: CC, SS, SW, W

ANTH 173 (GS 173) Archaeology of the Middle East 4 Credits
Covers major archaeological findings from Iraq, Iran, Israel, Palestine, Jordan, Egypt, and Turkey, as well as historical context surrounding those findings. Learn about palaces, temples, fortresses, pyramids, tombs, and ancient cities that archaeologists have excavated—but also about who excavated these sites and why. Answer questions like: Who built the pyramids? How did writing begin? And: Why is the Rosetta Stone now in England? How has our knowledge of the past been shaped by the relationship between archaeology and colonialism?
Attribute/Distribution: CC, Q, SS, SW

ANTH 176 (ARCH 176, ART 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ANTH 178 Mesoamerican Archaeology 4 Credits
Ancient civilizations of Mesoamerica: Olmec, Zapotec, Maya, Toltec, and Aztec. Reconstructions of urban centers, political and economic organizations, and theories of the Mayan collapse.
Attribute/Distribution: CC, SS, SW, W

ANTH 182 North American Indians 4 Credits
Culture areas of native North America prior to substantial disruption by European influences north of Mexico. Environmental factors and cultural forms.
Attribute/Distribution: CC, SS, SW

ANTH 184 (LAS 184) Indigenous Cultures of Latin America 4 Credits
This course examines social change in Latin America from the perspective of indigenous peoples. Main goals are to develop an appreciation for the diversity of cultures found in Latin America, explore anthropological concepts like cultural ecology, ethnicity, acculturation, and religious syncretism, and to apply these concepts to contemporary issues, including cultural survival, human rights, and environmental sustainability.
Attribute/Distribution: CC, SS, SW, W

ANTH 187 (ASIA 187, GS 187) Contemporary Southeast Asia 4 Credits
Southeast Asia is said to be on the rise. But from where has Southeast Asia risen? And what are the social consequences of this so-called rise? Addressing these questions, this course provides a broad introductory overview of contemporary Southeast Asia, surveying the region's extraordinary diversity and ongoing political, economic, and sociocultural transformations. Through engagement with ethnographic materials, the course further explores how everyday Southeast Asians negotiate and contend with ongoing challenges associated with the forces of globalization.
Attribute/Distribution: CC, SS, SW

ANTH 191 Special Topics 4 Credits
Special topics in anthropology.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, SW, W

ANTH 212 Doing Archaeology 4 Credits
Principles of archaeological method and theory. Excavation and survey methods, artifact analysis, dating techniques, and cultural reconstruction. Includes field project. Mandatory lab.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS, NW, Q

ANTH 213 Culture Theory 4 Credits
This course immerses students in anthropological theories that seek to explain global cultural diversity, patterns of similarities, and evolution of societies through time. Students will learn how anthropological theories help us to understand contemporary cultural issues, solve real-world problems, and foster an informed perspective on what it means to be human.
Attribute/Distribution: CC, HE, SS, W

ANTH 214 How to Study Culture 4 Credits
What is culture? How do anthropologists study the vast diversity of human cultures? How can we use anthropology to better understand our own culture? Through the hands-on practice of ethnographic methods, including participant observation and qualitative analysis, students will learn ethical, analytical, and practical considerations for doing research into human belief and behavior.
Attribute/Distribution: SS, SW

ANTH 215 Field School 1-8 Credits
Field school in archaeology or ethnography. Maximum of eight credits for a single season or field experience.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, NS, SW

ANTH 227 Archaeological Theory 4 Credits
Explores important issues in the interpretation of archaeological material. Issues include variable utility of anthropological analogies, unevenness of data, reconstructions of past cultures, processual and post-processual approaches. Students will write a sample NSF proposal.
Attribute/Distribution: CC, HE, SS

ANTH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ANTH 301 Violence of Science 4 Credits
We are living in a period of extreme skepticism about science. In this course, we will consider some reasons why, and examine how science has long been tied up with violence. We will learn about small, everyday violences of science as well as the long term histories of the violence of science, and will begin to imagine a future of peaceful science, inclusive science, healing science: science without violence.
Attribute/Distribution: CC, SS, SW

ANTH 304 (EVST 304) Socio-cultural Foundations of Environmental Policy 4 Credits
This course is based on the premise that social and ecological sustainability require new policy approaches. Drawing on social, organizational, and behavioral theory, students will learn techniques for analyzing and critiquing existing environmental policies and designing more effective policies. Case studies highlight how cultural values, social norms, public opinion and politics shape policies and their outcomes. We examine the entire policy process from how environmental problems are defined, to how organizations implement policies and how policies are evaluated.
Attribute/Distribution: CC, SS, SW, W

ANTH 311 (AAS 311, FILM 311) African Culture on Film 4 Credits
Cinematic representations of Africans and their culture are nearly as old as cinema itself.This course surveys films depicting African peoples, some made by outsiders but mostly by Africans themselves, to explore questions about culture, identity, race, and power. From ethnographic filmmakers like Jean Rouch and pioneers like Ousmane Sembene through today's flourishing Nollywood industry, cinematic depictions of life on the African continent have changed the way the world sees Africans and their place in the world.
Attribute/Distribution: HU, SS

ANTH 317 (AAS 317, GS 317) So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development 4 Credits
We are often motivated by the desire to "give back"-- feed the hungry, heal the sick, and help those less fortunate than ourselves. Anthropological research on humanitarian aid, development projects, and other interventions meant to improve human lives in various contexts shows us why these efforts often go awry. Focusing primarily on settings outside the U.S., students will consider the pitfalls of developmental and humanitarian interventions as well as the crucial role of local knowledge in addressing complex global problems.
Attribute/Distribution: CC, SS, SW, W

ANTH 320 (GS 320) Global Capitalism 4 Credits
Anthropological approach to the forms and effects of global capitalism. Topics include the structure of contemporary global capitalism, including the growth of multinational corporations, flexible corporate strategies, overseas manufacturing, and global branding and marketing; the impact of global capitalism on the environment and on the lives of people in "Third World" countries; consumer culture and the diversity of non-Western consumption practices; alternative capitalist systems.
Attribute/Distribution: CC, SS, SW, W

ANTH 325 Economic Anthropology 4 Credits
Cross-cultural perspectives on the ways people produce, distribute, and consume goods; how these systems are organized; and how they are connected with other aspects of society, particularly political and ideological systems.
Attribute/Distribution: CC, SS, SW

ANTH 335 (REL 335) Religion, Witchcraft And Magic 4 Credits
Addresses broad questions about supernatural beliefs as systems of meaning and as practical and moral guides, with a focus on theoretical explanations for supernatural beliefs and the function of religious specialists in the social organization of cultures.
Attribute/Distribution: CC, SS, SW

ANTH 339 Seminar In Anthropology 4 Credits
Topics in anthropology. Varying semester to semester: human evolution, politics and law, introduction to linguistics, human use of space, anthropology of deviance.
Repeat Status: Course may be repeated.
Prerequisites: ANTH 001 or ANTH 011 or SOC 005 or SOC 021 or PSYC 021 or SOC 001
Attribute/Distribution: SS

ANTH 353 (EVST 353, GS 353) Ethnobotany: People and Plants 4 Credits
This course explores the meanings and uses given to plants by diverse cultures in their unique ecological settings. Ethnobotany combines botany and cultural anthropology to study how people classify, use, and manage plants for medicine, food, and ritual. This course introduces the history, methods, theory, and practical applications of ethnobotany, including plant conservation, sustainable development, and cultural survival. Special emphasis will be placed on learning to do ethnobotany through student research projects.
Attribute/Distribution: CC, SS, SW, W

ANTH 366 (GS 366) Power, Preparedness, Precarity: Urban Resilience in an Age of Uncertainty 4 Credits
We have learned to expect the end of the world as we know it: sea levels are rising, carbon fuel reserves are diminishing, global power structures are shifting. This course asks how we can respond both socially and materially in the face of uncertainty. How can urban planning be used as an instrument of social control--or social change? How do we conceptualize themes like crisis and the natural? And how are new imaginations of the built environment emerging in response.
Attribute/Distribution: CC, SS, W

ANTH 377 Archaeology Of Death 4 Credits
Examines what we can determine about the past from human remains. Class will study health, age, and disease from the analysis of human bone, the cultural aspects of burial and funerals, and take part in a field project in Nisky Hill Cemetery in Bethlehem.
Attribute/Distribution: CC, SS, SW, W

ANTH 389 Honors Project 1-8 Credits

ANTH 391 Special Topics 4 Credits
Special topics in anthropology.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 393 Supervised Research 1-4 Credits
Conducting anthropological research under the supervision of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 395 Internship 1-4 Credits
Supervised experience in a setting suitable to anthropological or sociological analysis. May be repeated once for credit. Open only to department majors.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 399 Senior Thesis 2-4 Credits
Research during senior year culminating in senior thesis. Required for anthropology majors seeking departmental honors. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

Sociology and Anthropology Courses

SOAN 120 (ETH 120, HMS 120) Values and Ethics of Community-Engaged Research 4 Credits
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.
Attribute/Distribution: CC, SS, SW

Sociology Courses

SOC 001 Introduction to Sociology 4 Credits
Patterns of social interaction, group behavior and attitudes provide a focus on the relationship of the individual to society. Social structure and social change within the institutions of society provide a focus on the relationship of society to the individual. The influences of social class, gender and race are explored at each level of analyses. Theories, methods and research results provide micro and macro models for understanding society.
Attribute/Distribution: CC, SS, SW

SOC 002 Social Problems 4 Credits
A sociological perspective on a variety of social problems. Specific topics vary, but include problems related to social class, race, gender, and sexual identity in social institutions such as the family, healthcare, the media, the environment, the educational system, political system, and criminal justice system. Both problems and solutions to contemporary social problems are analyzed at both micro and macro levels.
Attribute/Distribution: CC, SS, SW

SOC 012 Statistics for Understanding the Social World 4 Credits
An introduction to basic statistics in the social sciences. Emphasis is on the statistical concepts underlying calculations and formulas, and data analysis in the context of social science research. The course covers two main areas: basic descriptive statistics and inferential statistics. These concepts are taught through real world data using professional statistical software. By the end of the course, students will possess the skills necessary to both use and critically read and interpret statistical information in everyday life.
Attribute/Distribution: CC, Q, SS, SW

SOC 091 Special Topics 4 Credits
Special topics in sociology.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, SW

SOC 100 Seminar in Sociology 1-4 Credits
Topics in sociology.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 102 (HMS 102) Sociology of Mental Health 4 Credits
This course will provide an introduction to the sociology of mental health. You will learn how the social world influences our well-being, how the line between health and illness (“normal” and “crazy”) is socially constructed, and how mental health treatment has changed over time. We will also delve into demographic patterns of mental health and discuss the social stigma that surrounds mental illness, mental health treatment, and diagnosis. Throughout the course, we will discuss contemporary issues through a sociological lens.
Attribute/Distribution: CC, SS, SW

SOC 103 (AAS 103) Race and Ethnicity in the Contemporary U.S. 4 Credits
Examines race and ethnicity from a sociological perspective. Focus on the role of the major racial and ethnic communities in modern American society. Explores the roles of race and ethnicity in identity, social relations, and social inequality. Topics include racial and ethnic communities, minority/majority groups, assimilation, prejudice and discrimination, identity, and the social construction of the concept of race.
Attribute/Distribution: CC, SS, SW

SOC 104 (POLS 104) Political Sociology 4 Credits
An introduction to political sociology through an examination of the major sociological questions concerning power, politics, and the state. Covers questions concerning state formation, nationalism, social movements, globalization, political culture and participation, and civil society.
Attribute/Distribution: CC, SS, SW

SOC 105 Social Origins Of Terrorism 4 Credits
What is terrorism and its causes? This course explores the roots of terrorism sociologically. It offers critiques of common theories of terrorism and presents several analytic tools for better understanding the phenomenon. In doing so, students are able to explore the social, historical, political, and religious roots of terrorism.
Attribute/Distribution: CC, SS, SW

SOC 106 (AAS 106, LAS 106) Race and Ethnicity in the Americas 4 Credits
How is it possible that someone who is officially considered black in the United States can embody different racial identities throughout current Latin America? Even more, how is it possible that people considered white nowadays were not officially so in early twentieth-century US (although they were viewed as white in the Latin American context at the same time period)? This course offers a historical comparative analysis of the nature and dynamics of race between the United States and Latin America.
Attribute/Distribution: CC, SS, SW, W

SOC 109 Calling Bullshit 4 Credits
We're awash in an information society, but do you really know how to make sense of any of it? Learn more about what sociology can teach us about the promise and pitfalls of reasoning with facts. Topics include data analytics, metrics, logical fallacies, psychological fallacies, sociological fallacies, fake news, cultural pressures, and more. This course will give you the skills you need to be a better student, scientist, citizen, consumer, and human being.
Attribute/Distribution: CC, SS, SW

SOC 114 (ASIA 114) Social Issues in Contemporary China 4 Credits
Dramatic economic, cultural and social changes are underway in China today and have aroused much debate among social scientists, East and West. The following social issues are critical for understanding China's development trajectory: inequality and poverty; rapid demographic shifts; provision of health care services; provision of education services; and becoming an "information society." We will explore how these issues intersect with old hierarchies in China, urban-rural differences, and gender differences.
Attribute/Distribution: CC, SS, SW, W

SOC 115 A Nation of Immigrants: The American Experience 4 Credits
The course provides an introduction to contemporary immigration, conceptualizing it as a social and economic process, as well as a human experience that is simultaneously liberating and limiting. Through immigration we will analyze processes of assimilation and resistance, the construction of cultural boundaries, the development of modern nation-states, as well as the role race plays in current debates about immigrants. The course advances a critical perspective by questioning how immigration is framed in the West, particularly in the Unites States.
Attribute/Distribution: CC, SS, SW, W

SOC 118 Sociology of Culture 4 Credits
Introduction to the ways sociologists and other social scientists think about this thing called "culture," and help students become educated observers and analysts of culture throughout their lives. Topics include: how our brains and bodies are shaped during enculturation and socialization; how art, music, fashion, and myths are produced and shape our lives; how culture diffuses and changes; and how taste, knowledge, and values relate to status, power, and inequity.
Attribute/Distribution: CC, SS, SW

SOC 127 (WGSS 127) Sociology of Sexuality 4 Credits
Students in this course view human sexuality through a sociological lens. This includes theory, research methods, and topics such as LGBTQ identities, family formation, sex work, teenage sexuality, sadomasochism, and sexual technologies. We pay particular attention to ways in which sexual behavior is regulated, as well as social constructions of "the normal." Course material focuses on the United States, although students are encouraged to bring cross-national perspectives into papers and class discussions.
Attribute/Distribution: CC, SS, SW

SOC 128 (WGSS 128) Race, Gender, and Work 4 Credits
Race, Gender and Work is a class designed to help students understand racial and gender inequalities as they relate specifically to work and employment. We explore the origins and histories of inequalities, the ways in which inequalities persist and/or change today, and what steps might be taken toward creating a more equal society.
Attribute/Distribution: CC, SS, SW

SOC 130 Sociology of Sports 4 Credits
This course provides an encompassing explanation of the process of globalization in the twentieth century through exploring the diffusion of sports, inquiring whether the sports has been connected to multiple forms of Empires, i.e. colonialism and imperialism. To do so, we will use sports to explore social and racial tensions, analyze mechanism of resistance, re-conceptualize the boundaries of social, economic and political spheres, examine the adoption of cultural practices, as well as understanding the construction of modern nation-states.
Attribute/Distribution: CC, SS, SW, W

SOC 138 The Sociology of Reality TV 4 Credits
How does The Bachelor shed light on courtship rituals, and what can Dance Moms teach us about the social meaning of childhood? Reality television shows may seem like frivolous fun, but they are also illuminating cultural artifacts that reflect contemporary American tastes, norms, and values. In this course—by reading sociological work, paired with episodes of reality shows—students learn to analyze these forms of entertainment through a social scientific lens.
Attribute/Distribution: CC, SS, SW

SOC 141 Breaking the Rules: Social Deviance 4 Credits
What institutions exert control over human behavior, and what are the incentives for adhering to social norms? Why do some people break those rules? What are the consequences of rule breaking? In this course, after examining theoretical scholarship on deviant behavior, students apply those theories to real-world examples— for example, criminal activities and policing, drug use, sexuality, body modification, mental illness, and atypical behavior at school and work…Are you ready? Let's get weird.
Attribute/Distribution: CC, SS, SW

SOC 155 (AAS 155, LAS 155) Afro-Latino Social Movements in Latin America & the Caribbean 4 Credits
This course focuses on Afro-Latinos who make up nearly 70% of the population of the Americas. Despite the large amount of people of African descent living in the Americas, Afro-Latinos are an understudied population who face significant amounts of racial discrimination in their countries. Who are Afro-Latinos? Where do they live? How are they challenging the racism that they face? These are questions we will tackle in this course.
Attribute/Distribution: CC, SS, SW

SOC 160 (HMS 160) Medicine and Society 4 Credits
Sociological perspectives on health, illness, and medical care. Focus on social epidemiology, social psychology of illness, socialization of health professionals, patient-professional relationships, medical care organization and policies.
Attribute/Distribution: CC, SS, SW

SOC 162 (GS 162, HMS 162) HIV/AIDS and Society 4 Credits
Impact of the AIDS epidemic on individuals and on social institutions (medicine, religion, education, politics, etc.); social and health policy responses; international experience; effect of public attitudes and policy on people affected directly by AIDS.
Attribute/Distribution: CC, SS, SW

SOC 163 (AAS 163) Sociology of Hip Hop Culture 4 Credits
Hip Hop culture is a complex form of artistic practices reflecting and impacting the environments in which they were produced. Through readings, music and video, this class will uncover the origins of Hip Hop by examining the musical history of the Afro-diaspora in the 20th century. Further study will reveal how the young Bronx, NY underclass in the 1970s fused elements of past musical styles with their own personal and political expression that sparked a worldwide phenomenon and culture industry.
Attribute/Distribution: CC, SS, SW

SOC 164 (AAS 164, WGSS 164) Sociology of Black Families 4 Credits
The objective of this course is to help students learn more about Black family experiences within the United States and globally. In approaching the course with an intersectional lens, students will learn about the varied experiences of Black families, and the ways in which these experiences are embedded in empowerment, disempowerment, and self-actualization. Students will leave the course understanding Black families at the intersection of fatherhood, motherhood, marriage, singlehood, childrearing, LGBTQ families, interracial families, transnational families, and aging.
Attribute/Distribution: CC, SS, SW

SOC 166 Money, Power, Prestige: Social Stratification" 4 Credits
Who gets what and why? How does a person's social origin determine their social position later in life? Why do some groups maintain greater access to money and power than do others? Is wealth, influence, and prestige concentrated in a small group of 'power elite'? And when and why do the powerful fall? Course addresses these questions through the sociological study of stratification, with an emphasis on social mechanisms and processes.
Attribute/Distribution: CC, SS, SW

SOC 171 (REL 171) Religion And Society 4 Credits
An introduction to the sociology of religion. Covers both classical and contemporary approaches to understanding religion in society. Emphasis on religious beliefs and practices in the U.S., sources and contours of religious change, and effects of religion on individuals and society. Specific topics include religious fundamentalism, conversion, secularization, religious authority, religion in public life, social change, and terrorism, and religious impacts on personal health, educational attainment, and family life.
Attribute/Distribution: CC, SS, SW

SOC 186 (ASIA 186) Understanding China through Films 4 Credits
We will use documentary and feature films to demonstrate how Chinese people experience and interpret social, political, economic and cultural changes. Through sociological interpretation of film, we will focus on education provision, migration, environmental concerns, gender relations, poverty, and changing cultural norms and values. We will explore how these social issues have been intensified with economic reform and how they intersect with major historical hierarchies in China.
Attribute/Distribution: CC, SS, SW

SOC 191 Special Topics 4 Credits
Special topics in sociology.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, SW, W

SOC 211 Research Methods and Data Analysis 4 Credits
Survey of social science research methods common in sociology and anthropology. Covers research question formulation, design, and analysis and interpretation of data. Ideally taken by majors in sophomore year.
Attribute/Distribution: Q, SS, SW

SOC 212 Development of Social Theory 4 Credits
This course introduces some of the most influential theoretical ideas in sociology. It focuses on understanding the differences among several classical theoretical traditions and their strengths and weaknesses in analyzing societies. It also helps students learn to apply social theory to contemporary sociological research and problems, learning the ways theory can be used to answer questions and problems societies face today. Ideally taken by majors in sophomore year.
Attribute/Distribution: SS, SW, W

SOC 221 Qualitative Methods 4 Credits
Provides a survey of methods social scientists use to collect data that is not easily reducible to numbers, such as in-depth interviewing, content analysis, participant-observation, comparative-historical analysis, and ethnography. Offers hands-on, practical experience with these methods as well as model cases of the methods as they are used by experts.
Attribute/Distribution: CC, SS, SW

SOC 222 Introduction to Survey Research 4 Credits
Surveys are important tools to provide us information about the world around us, from general populations' values and attitudes to consumers' behaviors. This course introduces the basic concepts and skills of survey methods, including questionnaire design, sampling procedure, implementing the survey, and evaluating quality of survey results. Through designing and conducting a survey of Lehigh students on topics of class' own choosing, students will be critical readers of any survey data, and be able to design and conduct original surveys.
Attribute/Distribution: CC, Q, SS, SW

SOC 223 It's Who You Know: Understanding Social Networks 4 Credits
Who knows who? Who knows what? Who is influential? Why are your friends more popular than you are? How do ideas, diseases, fashion trends and innovations spread through groups? Such questions and more can be answered using network analysis. This class will explore key concepts and methods for understanding networks and how they shape social life.
Attribute/Distribution: CC, Q, SS, SW

SOC 226 Computational Text Analysis 4 Credits
Provides the fundamentals for designing and conducting computational text analysis projects from a social scientific perspective. We will touch on several advanced topics in this rapidly growing field, such as web scraping, sentiment analysis, classifiers, structural topic modeling, text networks, machine learning, natural language processing, and word embeddings. Hands-on analysis in the R statistical computing environment will be integral to the course, though no prior coding experience is required.
Attribute/Distribution: Q, SS, SW

SOC 229 Data Visualization in the Social Sciences 4 Credits
Our world is increasingly data-driven; how can we as social scientists take advantage of data to understand and address contemporary social problems? This course will introduce students to the visualization of quantitative social science data. Students will learn to use R to clean, organize, and visualize real-world data. These skills are invaluable for myriad future careers in medicine, policy, non-profits, finance, and more. No prior programming experience is required.
Prerequisites: SOC 012 or MATH 012 or ECO 045
Attribute/Distribution: Q, SS, SW

SOC 300 Apprentice Teaching 1-4 Credits

SOC 313 (AAS 313) Keep the Change: Social Movements in Society 4 Credits
Interested in how social change works? Or how to stop it? This seminar provides an introduction to the origins, dynamics, and consequences of historical and contemporary social movements, beginning with the American Civil Rights Movement. Students will discuss and develop their own ideas on these issues through examination of social movement theory and empirical case studies. They will also explore more general questions about the relationship between human agency, social structure, and historical change. More information is available at https://wordpress.lehigh.edu/zim2/soc313/.
Attribute/Distribution: CC, SS, SW

SOC 314 (AAS 314, GS 314, HMS 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: CC, SS, SW, W

SOC 316 Social Epidemiology 4 Credits
Social epidemiology is the study of the distribution and social determinants of health and disease in human populations. This course introduces the basic principles of epidemiological study design, analysis and interpretation, covering topics such as how a disease spreads across populations and how public health interventions can help control or reduce the spread of disease. This course also reviews epidemiology as a social science by reviewing the social causes and consequences of health.
Attribute/Distribution: CC, SS, SW

SOC 317 Seminar in Globalization and Social Issues 4 Credits
Advanced seminar that focuses on research and discussion of specialized topics in globalization and social issues. Subjects vary by semester. Junior or senior standing and departmental permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, SS, SW

SOC 319 (GS 319) The Political Economy of Globalization 4 Credits
Studies the relationship among economic, political and cultural forces in an era of globalization, focusing on how global capitalism, the world market and local economics shape and are shaped by social, cultural, and historical forces. Topics include political and cultural determinants of trade and investment; culture and the global economy; global capitalism, especially studied through the lens of culture; globalization and patterns of economic growth; cross-cultural study of consumerism; and poverty and inequality.
Attribute/Distribution: CC, SS, SW, W, WRIT

SOC 322 (GS 322, HMS 322) Global Health Issues 4 Credits
Sociological dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of 'traditional' and 'modern' beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.
Attribute/Distribution: CC, SS, SW, W

SOC 324 Sociology of Children and Childhood 4 Credits
This course examines children and childhood from a sociological perspective, with a focus on growing up as a social process. We will explore childhood as a time of socialization, and the role of children as active social agents, paying special attention to the ways in which children and childhood are entwined with other major social institutions. This course analyzes the intersections of children and childhood with fundamental social inequities related to gender, race, and class.
Attribute/Distribution: CC, SS, SW, W

SOC 325 (HIST 325, WGSS 325) History of Sexuality and the Family in the U.S. 3,4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post-World War II era. Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.
Attribute/Distribution: SS

SOC 328 (GS 328) Global Food Systems 4 Credits
Where does our food come from? How does it get to our tables? Why are there famines in some parts of the world and obesity epidemics in other parts of the world? This course will investigate these questions by focusing on food systems – the chains of social action that link food producers to food consumers. We will also explore a range of alternatives to global food systems that emphasize food democracy, security, and sustainability.
Attribute/Distribution: CC, SS, SW

SOC 331 (GS 331, WGSS 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: CC, SS, SW, W

SOC 332 (POLS 332) The Politics of Inequality 4 Credits
Examines the politics of gender, racial, and economic inequality in the U.S. Explores the effects of growing inequality on political representation, and the impact of government policy on perpetuating inequality. Class consciousness, and its effects on political beliefs and behavior, are examined.
Attribute/Distribution: CC, SS, SW

SOC 344 (WGSS 344) Bad Girls: Gender, Sexuality, Deviance 4 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss readings in the context of current events and popular culture.
Attribute/Distribution: CC, SS, SW, W

SOC 355 Sociology Of Education 4 Credits
Examines the social organization of education as a social institution and the role of schools in society. Focus is primarily on educational processes in the United States. Topics include: IQ, curriculum, tracking, educational inequality, primary/secondary/higher education, private vs. public, informal education and social capital, effects on and of race/class/gender, schools as agents of socialization, educational policy and school reform.
Prerequisites: ANTH 011 or ANTH 012 or SOC 001
Attribute/Distribution: CC, SS, SW, W

SOC 364 (WGSS 364) Sociology of Families 4 Credits
Sociological analysis of families in the United States, including investigations of historical and contemporary patterns. Issues addressed include parenting, combining work and family, divorce and remarriage, family policies.
Attribute/Distribution: CC, SS, SW, W

SOC 370 (EVST 370, GS 370) Globalization and the Environment 4 Credits
This course investigates how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes, focusing on the rapidly evolving global economic and political systems that characterize global development dynamics and resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution are key themes.
Attribute/Distribution: CC, SS, SW, W

SOC 374 Social Stratification: Race, Class, Gender 3 Credits
This course is an introduction to social stratification. Examines social inequality as an organizing principle in complex societies. Explores the intersection of the "great divides" of race, class, and gender. Through readings from classical sociological theory to cutting-edge literature we embark on a critical analysis of the causes and consequences of social stratification and social mobility in the United States and in a global context.
Prerequisites: ANTH 001 or SOC 001
Attribute/Distribution: CC, SS, SW

SOC 375 (REL 375) The Christian Right In America 4 Credits
What do we know about the Christian Right? Who are they? What do they believe? Where do they come from? Seminar explores answers to such questions through a focus on the history of the Christian Right as well as its ideologies and beliefs, the people who are a part of it, and its evolving relationship to the American political system.
Attribute/Distribution: CC, SS, SW, W

SOC 379 (AAS 379) Race and Class in America 4 Credits
This course focuses on the ways in which race and class intersect in the social, economic, and political structures of American society. Through sociological literature, fiction, nonfiction, film, and other media we will explore the place of race and class in American society. We will examine how race and class operate on a personal, "micro" level, while at the same time operating on a large scale, "macro" level.
Attribute/Distribution: CC, SS, SW

SOC 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

SOC 391 Special Topics 4 Credits
Special topics in sociology.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 393 Supervised Research 1-4 Credits
Conducting sociological or social psychological research under the supervision of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 395 Internship 1-4 Credits
Supervised experience in a setting suitable to anthropological or sociological analysis. May be repeated once for credit. Open only to department majors.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 399 Senior Thesis 2-4 Credits
Research during senior year culminating in senior thesis. Required for sociology/social psychology majors seeking departmental honors. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

Theatre

To study theatre is to examine its many internal disciplines. Acting and directing combine with design, technical theatre, dramatic literature and theatre history to form the body of our art. Students may pursue general theatre studies or focus on particular areas such as performance, design or history and literature. They may major in theatre, minor in theatre or participate strictly in our production program. Students may even complete a minor in theatre from outside the College of Arts and Sciences.

The bachelor of arts degree in theatre is granted after at least 48 credit hours of study. Because we believe that undergraduate theatre education should be broad-based with an emphasis on diversity of experience, students are encouraged to take a variety of courses outside the major. Many students complete double majors. Those with the talents and aspirations for a career in theatre have gone to graduate schools offering intense, pre-professional training. Other majors who have not pursued a theatrical career have gone from our program directly into careers in business, social services, and sales. Theatre study is an excellent preparation for vocations in which self-presentation is important, such as law. The problem-solving, analytical, and interpersonal skills gained from this discipline are applicable across a wide range of careers. An understanding and appreciation of the complex art of the theatre will enrich a lifetime.

The department's active production program is curricular and promotes collaborative projects involving students, faculty **(**https://theatre.cas.lehigh.edu/content/faculty/**)**, staff, and guest artists. Our large performance facility is the Diamond Theater **(**https://theatre.cas.lehigh.edu/content/diamond-theater/**)**, a 300-seat thrust theatre housed in the Zoellner Arts Center. The core of our work in this space is dedicated to productions featuring primarily student actors directed by faculty or guest artists. When possible, a highly qualified student may direct or design in this space. In addition to our own productions, we regularly invite outside professional performers and ensembles to work with us and perform. We also operate a lab theatre (Fowler Black Box Theater) for student and faculty experimentation. The availability of valuable hands-on experience and the very close working relationships developed between students and faculty uniquely characterize the Department of Theatre. Performance and administrative internships are available to qualified students with guidance from a faculty mentor.

Students interested in designing a major or minor in theatre should consult with the department chairperson. Experienced theatre students with questions regarding accurate placement in any theatre course should, likewise, consult with the chairperson.

Lehigh University is an accredited institution by the National Association of Schools of Theatre.

For more information, visit: https://theatre.cas.lehigh.edu/

THEATRE MAJOR

Through the selection of appropriate courses **(**https://catalog.lehigh.edu/courselisting/thtr/**)**, students may concentrate their major in one of these areas:

- Acting/Directing
- Design/Technical Theatre
- Theatre History/Dramatic Literature
- General Theatre Studies

The major in theatre consists of 48 hours distributed as follows:

Coursework required of all majors, 24 hrs:

THTR 060	Dramatic Action	4
THTR 087	Performance Design	4
THTR 127	History of Theatre I	4
THTR 128	History of Theatre II	4
Thtr Acting (any appropriate level)		4
AND		
two courses from the following:		
THTR 020	Stagecraft I	2
THTR 025	Costume Construction I	2
THTR 027	Lighting Technology and Production I	2

Production Requirement, 8 hrs

Four courses from the following:	
THTR 021	Stagecraft II
THTR 022	Stage Properties and Decoration
THTR 023	Basic Scene Painting

THTR 026	Costume Construction II
THTR 028	Lighting Technology and Production II
THTR 030	Sound Technology and Production I
THTR 031	Sound Technology and Production II
THTR 035	Performance
THTR 045	Stage Management
THTR 067	Backstage Crew
THTR 068	Course THTR 068 Not Found
THTR 069	Course THTR 069 Not Found
THTR 175	Special Projects
Advanced courses may be substituted.	

Electives, 16 hrs.
Four courses carefully selected with an advisor, emphasizing depth or breadth of study.

Recommended courses from other departments
The departments of art, architecture and design, English, modern languages and literature, music, and others, all offer courses of value to a theatre major or minor. Consult with your advisor about enriching your academic career outside the theatre department.

THEATRE MINOR

Theatre Minor
The minor in theatre consists of 24 hours of course work selected in consultation with a departmental advisor. Typically, this includes five 4-credit courses and two 2-credit theatre production courses. The minor in theatre must include some academic diversity beyond a single curricular area. The department participates in an interdisciplinary minor in apparel design.

DEPARTMENTAL HONORS

The exceptional student may elect to pursue departmental honors in the senior year. This student must have a GPA of 3.3 in all theatre courses presented for the major. No later than the fall of the senior year the student, with faculty supervision, elects a special project in a particular area of theatre. This may take the form of preparing to direct a play, researching a role to be performed, preparing a design presentation, or researching in an area of theatre scholarship in preparation for the writing of a substantial report. In the next semester, usually the spring of the senior year, the report or project would be executed. The student would enroll in two, four-credit independent study courses, one each senior semester.

THE ACTING SEQUENCE

Students with little or no prior acting experience should elect THTR 011, Introduction to Acting, as their first course. Students with some prior acting experience should consult with the department chairperson for accurate placement and waiver of the THTR 011 prerequisite.

Courses

THTR 001 Introduction To Theatre 4 Credits
Foundations of theatre: historical, literary and practical.
Attribute/Distribution: HE, HU

THTR 011 Introduction To Acting 4 Credits
Preparation for scene study and characterization.
Attribute/Distribution: AL, HU

THTR 020 Stagecraft I 2 Credits
Introduction to the art of scenic construction and technical theatre. Scenic construction materials, techniques, tools, rigging and safety. Practical experience in executing scenery for the stage.
Attribute/Distribution: AL, HU

THTR 021 Stagecraft II 2 Credits
A continuation of THTR 20 – Stagecraft I. Specialty tools, materials, methods and problem-solving. Practical experience in executing scenery for the stage.
Prerequisites: THTR 020
Attribute/Distribution: AL, HU

THTR 022 Stage Properties and Decoration 2 Credits
Creating props and decor for the stage. Production assignment as assistant property master.
Attribute/Distribution: AL, HU

THTR 023 Basic Scene Painting 2 Credits
Painting for the stage. Production assignments painting with scenic artist.
Attribute/Distribution: AL, HU

THTR 025 (DES 025) Costume Construction I 0,2 Credits
Introduction to the art of costume construction. Costume construction materials, techniques, tools and safety. Practical experience in executing costumes for the stage.
Attribute/Distribution: AL, HU, Q

THTR 026 (DES 026) Costume Construction II 0,2 Credits
Continuation of THTR 25 - Costume Construction I, including pattern drafting, fitting, crafts and accessories. Materials, methods and problem solving. Practical experience in executing costumes for the stage.
Prerequisites: THTR 025
Attribute/Distribution: AL, HU, Q

THTR 027 Lighting Technology and Production I 2 Credits
Introduction to the art of lighting technology and production. Lighting techniques, tools and safety. Practical experience in executing lighting for the stage.
Attribute/Distribution: AL, HU

THTR 028 Lighting Technology and Production II 2 Credits
Specialty equipment, methods and problem solving. Practical experience in programming the lighting console for production. Assignment as light board operator on a production.
Attribute/Distribution: AL, HU

THTR 030 Sound Technology and Production I 2 Credits
Introduction to the theory, equipment and practice of sound reinforcement for the theatre, including microphone theory, speaker use and placement, digital audio networks, and live mixing.
Attribute/Distribution: AL, HU

THTR 031 Sound Technology and Production II 2 Credits
Advanced Sound Reinforcement techniques including multiple source mixing, specialty equipment and audio system design and installation.
Prerequisites: THTR 030
Attribute/Distribution: AL, HU

THTR 035 Performance 2 Credits
Performing in a department-approved production.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HU

THTR 045 Stage Management 2 Credits
Organization, scheduling, coordination of various production specialties. Production assignment as assistant stage manager.
Attribute/Distribution: AL, HU

THTR 053 (ASIA 053) Bollywood Dance 2 Credits
Bollywood is a term compounded from "Bombay" (now Mumbai) and “Hollywood.” Bollywood dance is the movement form used in Indian films - a unique and energetic style inspired by Indian folk dance and Indian classical dance, Middle Eastern, and modern dance. Explore how each of these unique styles combine to create modern Bollywood dance. Learn the fundamental movements, gestures, and expressions that create the Bollywood dance aesthetic, and how they are applied in choreographed sequences.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 055 (ASIA 055) Indian Classical Dance 2 Credits
Introduction to the history and practice of Bharatanatyam, a classical dance style of India. Understanding basic footwork, hand gestures, and body movements, and how they are combined to convey emotion, meaning, and imagery. Traditional repertoire, music, terminology, and the spectator's experience of the dance.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 056 Jazz Dance 2 Credits
In this class, students will explore that many different styles of Jazz in parallel to the African Diaspora along with the American vocabulary and vernacular. Students will explore Stile's spending from Broadway jazz to contemporary jazz to modern jazz to commercial Jazz. Learning the foundation that contributes to these styles. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 057 Modern Dance 2 Credits
Modern dance styles and combinations. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 060 (ENGL 060) Dramatic Action 4 Credits
How plays are put together; how they work and what they accomplish. Examination of how plot, character, aural and visual elements of production combine to form a unified work across genre, styles and periods. Recommended as a foundation for further studies in design, literature, or performance.
Attribute/Distribution: CC, HE, HU, W

THTR 065 (ENGL 065) Introduction to Playwriting 4 Credits
An introduction to writing for the stage, with an emphasis on creating characters, exploring story and structure, experimenting with theatrical language, and working within the context of theatrical history and the wider world. This course combines in-class exercises with seminar-style discussion of the student's work.
Attribute/Distribution: AL, CC, HU, W

THTR 066 (AAS 066) Hip Hop Dance 2 Credits
Techniques, vocabulary, and history behind the various elements of the Hip Hop Movement. Focus upon the cultural influence of Hip Hop dance styles, and the overall social influence of the Hip Hop Movement.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 067 Backstage Crew 2 Credits
Production run crew assignment.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 072 (DES 072) Textile Design I 4 Credits
Textile printing has brought about revolutionary changes in textile design. Textile Design utilizes digital photography, scanning, drawing and image editing software to create botanical and geometric patterns for textiles.
Attribute/Distribution: AL, HU

THTR 076 (AAS 076) Hip Hop Dance II 2 Credits
Students familiar with the music genres and basic dance tropes of the Hip Hop movement will explore, develop, and apply them in combinations that weave the various elements of Hip Hop culture into a high energy dance. Focus on Hip Hop dance as it influences the contemporary world view and global aesthetics.
Repeat Status: Course may be repeated.
Prerequisites: THTR 066 or AAS 066
Attribute/Distribution: AL, HU

THTR 077 Ballet 2 Credits
Classical ballet for beginners and those who have had some training. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, HU

THTR 087 (DES 087) Performance Design 4 Credits
Introduction to the process of creating integrated designs in theatre production. The study and practice of the principles of visual representation, historical and conceptual research and the study of theatrical styles.
Attribute/Distribution: AL, CC, HU

THTR 088 (DES 088) Digital Rendering 4 Credits
Explore the use of modern technology to develop and communicate design ideas with speed, clarity, and visual punch. Strategies geared toward increasing the young designer's confidence in presenting artistic concepts. Learn the basics of Photoshop and SketchUp and then apply those skills in creative execution of scenic, costume, and lighting renderings.
Attribute/Distribution: AL, HU

THTR 089 (DES 089) Introduction to Fashion Design 4 Credits
An introduction to conceptual garment design. Research, devise, and develop collections of apparel and accessories. Basic elements of design, fashion theory, design processes, and rendering techniques.
Attribute/Distribution: AL, CC, HU

THTR 111 (DES 111) Sound Design 2 Credits
Introduction to the study of the techniques and equipment used for theatrical sound design. Elements include audio theory, script analysis, field recording and editing audio in digital audio workstations.
Attribute/Distribution: AL, HU

THTR 126 (ARCH 126, ART 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society.
Attribute/Distribution: CC, HE, HU

THTR 127 (ENGL 127) History of Theatre I 4 Credits
A multi-cultural survey of dramatic literature and theatrical practice from its ritual origins to the 18th century.
Attribute/Distribution: CC, HE, HU

THTR 128 (ENGL 128) History of Theatre II 4 Credits
A multi-cultural survey of dramatic literature theatre and theatrical practice from the 18th century to the present day.
Attribute/Distribution: CC, HE, HU, W

THTR 129 (DES 129, WGSS 129) History of Fashion and Style 4 Credits
Global trends in dress and culture from pre-history to today. The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: CC, HE, HU

THTR 130 Drafting For The Theatre 4 Credits
Theatre drafting techniques and conventions. Material, methods and theory in stage graphics. Model building techniques and practice. An introduction to computer drafting.
Attribute/Distribution: AL, HU

THTR 132 (AAS 132) Hip Hop Theatre 4 Credits
Introduction to the creation and performance of Hip Hop theatre. Exploration of the history and culture of Hip Hop through original written material, live performance, music, film, video and web based content. Public performances. Must audition. Consent of instructor required.
Attribute/Distribution: AL, CC, HU

THTR 135 Playwriting II 4 Credits
For students interested in continuing and deepening their writing for the stage. Instructor approval required.
Attribute/Distribution: AL, CC, HU, W

THTR 140 (AAS 140) African American Theatre 4 Credits
Studies in African American theatre: literary, and practical and historical.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU

THTR 144 Directing 4 Credits
Introduction to the theatrical director's art. Research, rehearsal techniques, scene work. Acting experience as determined by the department or consent of chair.
Repeat Status: Course may be repeated.
Prerequisites: (THTR 060)
Attribute/Distribution: AL, CC, HU

THTR 145 Advanced Stage Management 1-4 Credits
Advanced application, practice, and leadership development of stage management role and skills: production assignment as stage manager.
Attribute/Distribution: AL

THTR 147 Acting Modern Realism 4 Credits
Characterization and scene study in modern realistic drama e.g. Ibsen, Chekov, O'Neill, Hellman, Miller and Williams.
Prerequisites: THTR 011
Attribute/Distribution: AL, CC, HU

THTR 148 Acting Contemporary Drama 4 Credits
Characterization and scene study in modern contemporary drama.
Prerequisites: THTR 011
Attribute/Distribution: AL, CC, HU

THTR 152 Stage Make-up 4 Credits
Theatrical make-up techniques for the actor and designer.
Attribute/Distribution: AL, CC, HU

THTR 154 (DES 154) Scene Painting 4 Credits
Study and practice of basic and advanced methods of painting for the theatre. Includes basic elements and principles of design, color theory, the influence of light, atmosphere and aesthetics for the theatre.
Attribute/Distribution: AL, HU

THTR 155 (DES 155) Model Building and Rendering 4 Credits
The art and practice of model building and rendering for the stage. Special techniques including scale furniture, soldering, acrylic painting and hand drafting.
Attribute/Distribution: AL

THTR 172 (DES 172) Textile Design II 4 Credits
Building on skills and concepts developed in Textile Design I, students will develop their own voice in textile, apparel and accessory design.
Prerequisites: DES 072 or THTR 072
Attribute/Distribution: HU

THTR 175 Special Projects 1-4 Credits
Theatrical topics of current or special interest.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HU

THTR 177 (JST 177, REL 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels-as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HE, HU, W

THTR 185 Production Seminar 1-4 Credits
Practicum in various approaches to theatre production, e.g. performance ensemble. Must audition, or consent of the chairperson required.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HU

THTR 186 (DES 186) Lighting Design 4 Credits
An introduction to the art and practice of lighting design for the theatre. Script analysis, research, and the interplay of lighting technology and design. Students will develop a sense of the dramatic while creating a portfolio of lighting designs.
Attribute/Distribution: AL, CC, HU

THTR 188 (DES 188) Scenic Design 4 Credits
An introduction to the art and practice of scenic design for the theatre. Script analysis, research, drafting and modeling techniques. Students will develop a sense of the dramatic while creating a portfolio of scenic designs.
Attribute/Distribution: AL, CC, HU

THTR 189 (DES 189) Costume Design 4 Credits
An introduction to the art and practice of costume design for the theatre. Script analysis, research, and rendering techniques. Students will develop a sense of the dramatic while creating a portfolio of costume designs.
Attribute/Distribution: AL, CC, HU

THTR 236 Acting Presentational Styles 4 Credits
Elements of characterization and scene study in presentational dramatic literature from classical through post-modern periods. Must have completed 100-level acting course.
Prerequisites: THTR 147 or THTR 148
Attribute/Distribution: AL, CC, HU

THTR 244 Acting Shakespeare 4 Credits
Monologue scene study and ensemble work from Shakespeare's dramatic and poetic canon.
Prerequisites: THTR 147 or THTR 148
Attribute/Distribution: AL, CC, HU

THTR 245 Advanced Directing 4 Credits
Continuation of Theatre 144. The director's voice. Supervised practical experience.
Prerequisites: (THTR 144)
Attribute/Distribution: AL, CC, HU

THTR 253 Scene Painting II 4 Credits
Applied advanced scene painting methods for the theatre. Shop management for the scenic artist. Collaboration with designers and stage technology.
Prerequisites: THTR 154
Attribute/Distribution: AL, HU

THTR 260 Design and Technical Practicum 1-4 Credits
Scenic, costume, lighting or sound design or technical production projects for the theatre. Realized design or technical theatre production assignment and portfolio-building. Collaboration, process and presentation. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 272 (DES 272) Advanced Textile Design Workshop 4 Credits
Building on skills and concepts developed in Digital Textile Design II, students work towards a maturing studio practice within an atmosphere of rigorous critique. Further exploration in the conceptual research and material tools of surface design in textiles developed in DES 072 and 172, with experimentation in broader media is encouraged. An expansion of knowledge of textiles and apparel in the 21st Century will inform the development of a design practice and portfolio. Prerequisite: DES 172 / THTR 172.
Repeat Status: Course may be repeated.
Prerequisites: DES 172 or THTR 172
Attribute/Distribution: HU

THTR 275 Internship 1-4 Credits
Professionally supervised work in theatres and theatrical organizations in the areas of performance, design, technical theatre, theatre administration and management. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

THTR 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

THTR 315 Senior Study 0 Credits
Seminar for senior theatre majors. Enhancement of current theatre studies while preparing for further theatre studies or activity.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

THTR 328 (ENGL 328) Topics in Shakespeare 3-4 Credits
This class explores why Shakespeare's plays and poems still resonate today. We will focus in particular on how Shakespeare's plays have been used to explore questions of gender, race and social class. We'll read some of the "greatest hits" as well as a few lesser-known works, focusing first on how these texts were understood in the time they were written and then on why and how they inform our perspective today.
Attribute/Distribution: CC, HE, HU, W

THTR 351 Advanced Special Projects 1-8 Credits
Independent study in theatre. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, W

THTR 389 Honors Project 1-8 Credits
Opportunity for undergraduate majors in Theater to pursue a project for departmental honors. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

Women, Gender, and Sexuality Studies

Website: http://wgs.cas.lehigh.edu

Women, Gender, and Sexuality Studies (WGSS) at Lehigh University is an interdisciplinary field of academic inquiry that critically examines gender and sexuality from an intersectional model that takes into account the manner in which class, race, and power co-constitutively shape and impact gendered and sexed identity construction. In the best tradition of a liberal arts education, Women, Gender, and Sexuality Studies encourages thinking that is critical and constructive, multifaceted and intersectional in order to redesign knowledge, and gain a better understanding of how identities shape and are shaped by the social world in which we live. Offering an undergraduate major and minor, a Graduate Certificate, and a host of faculty and student-focused events and resources, WGSS works to be a space of professional growth, intellectual development and maturity, and a knowledge leader on campus, in the surrounding Lehigh Valley, and abroad.

UNDERGRADUATE MAJOR IN WOMEN, GENDER, AND SEXUALITY STUDIES

The Women, Gender, and Sexuality Studies BA will provide students an in depth education in an interdisciplinary field of academic inquiry that critically examines the diverse realities of women's lives and the ways in which gender and power differentials shape human lives and human societies. WGSS pursues a fundamental critique of knowledge by challenging the basic assumptions, methods of inquiry, theoretical frameworks, and knowledge claims of traditional fields of inquiry that have thought it unimportant to study women, gender, or sexuality. WGSS seeks to create new paradigms of knowledge and inquiry, to develop more truthful and comprehensive understandings of humans and our world, and to explore nonsexist alternatives for more richly human lives and more fully human social orders.

Each semester, a complete list of WGSS course offerings can be found on the WGSS website or in the Office of Interdisciplinary Programs, Maginnes Hall, Suite 280.

The WGSS major requires 34-36 credits of coursework and is designed to complement other areas of study within CAS in order to facilitate double-majors for our students. WGSS majors can stand alone; however, many students find the major an invaluable asset as part of a double major. The major will have a core curriculum, a concentration (social sciences or humanities), electives, and a senior experience.

Major Core Courses

Major Core Courses		
WGSS 001	Gender and Society	4
WGSS 350	Seminar in Feminist Theory	4
Or another feminist or queer theory course approved by the Director		
Global/Diversity (select one of the following) [1]		4
WGSS/ASIA/MLL 115	Sex, War, Women, Art	
WGSS/AAS/HIST 126	How Black Women Made Modern America	
WGSS/AAS/GS/ HIST 131	Women, Gender, Sexuality and Race in African Societies	
WGSS/ASIA/MLL 135	POWER, (WO)MEN, SILENCE	
WGSS/ASIA/REL 173	Sex, Celibacy and Sainthood: Gender and Religion in East Asia	
WGSS/ASIA/HIST/ MLL 256	Women in Pre-Industrial China	
WGSS/GS/SOC 331	Gendered Experience of Globalization	
WGSS/ASIA/GS/ POLS 369	Women's Movement in China	
Or another appropriate course approved by the director.		
Major Concentration		
Students must concentrate in Social Science (SS) or Humanities (HU)		8
Select two courses in SS or HU [2,3]		
Major Non-concentration		
Select one of the following: [2,3]		4
One SS course if HU concentration		
One HU course if SS concentration		
Major Electives		
Select any combination of SS and HU courses [2,3]		8
Major Senior Experience		
Select one of the following:		2-4
WGSS 271	Independent Reading and Research	
WGSS 330	Internship in Women, Gender and Sexuality Studies	
WGSS 373	Internship On-Campus	
WGSS 399	Senior Thesis	
Total Credits		**34-36**

[1] Cannot be double-counted in categories.

[2] HU or SS courses must carry the WGSS course designation or be approved by the program director.

[3] Additional ND courses may fulfill HU or SS requirements with program director approval. These courses may include WGSS 091 Special Topics, WGSS 191 Special Topics, WGSS 291 Special Topics, WGSS 391 Special Topics, and ARTS 250 Communications, Cultures, Behaviors and Attitudes

HONORS IN WOMEN, GENDER, AND SEXUALITY STUDIES

In order to receive honors in Women, Gender, and Sexuality Studies, the student must attain a 3.5 grade-point average in courses presented for the major and a 3.2 grade-point average overall, and must take WGSS 399 Senior Thesis and write a thesis during their senior year.

UNDERGRADUATE MINOR IN WOMEN, GENDER, AND SEXUALITY STUDIES

The minor in WGSS engages students in the study of three interrelated subjects. The first is an examination of the cultural, historical, and social experiences and contributions of women. The second is an exploration of gender (the social construction of differential identity for males and females) and of the ways in which gender distinctions shape human consciousness and human society. The third is an examination of sex/gender and sexuality systems.

Nearly all academic disciplines have defined human nature and significant achievement in terms of male experience and have underestimated the impact of gender on social structures and

human lives. By contrast, WGSS courses attend to women's diverse experiences and perspectives and acknowledge the critical significance of gender and sexuality. By shifting the focus to women, gender, and sexuality, WGSS seeks to provide an alternative paradigm for understanding human experience. Students in WGSS courses are encouraged to reevaluate traditional assumptions about human beings, human knowledge, and human culture and society, and to explore nonsexist alternatives for a more fully human social order.

The minor in WGSS consists of a minimum of 18 credit hours. Students pursuing the minor are required to take the introductory course (WGSS 001) and one upper-level course from among those concerned with the theory and practice of women, gender, and sexuality studies. Courses completed must include at least one course in the arts and humanities and one course in the natural and social sciences. Students arrange their program in consultation with the program director.

Undergraduate Minor

WGSS 001	Gender and Society	4
Select 2 credits from following:		2
WGSS 271	Independent Reading and Research	
WGSS 330	Internship in Women, Gender and Sexuality Studies	
WGSS 373	Internship On-Campus	
Select one 300-level course		4
Select two electives or new course as approved [1]		8
Total Credits		**18**

1

One course must be HU and one course must be SS

GRADUATE CERTIFICATE IN WOMEN, GENDER, AND SEXUALITY STUDIES

The Graduate Certificate in WGSS is designed as a complement to a disciplinary graduate program or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of women and gender. In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the WGSS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons. A certificate in WGSS will be especially beneficial to those who wish to incorporate a broader perspective into their teaching (either in secondary or higher education), and qualifies them for positions that require such expertise. Additionally, individuals interested in fields such as social policy, human resources, and business will also gain from understanding how gender operates at individual, organizational, and institutional levels. Students will work closely with outstanding faculty from diverse disciplinary backgrounds.

Basic Requirements

WGSS 450	Seminar in Feminist Theory	3
Select three additional courses [1,2]		9
Total Credits		**12**

1

2 courses outside home department (for matriculating students)

2

No more than 6 credits at the 300-level

Admissions

Students in degree programs must be in good standing in their programs and are encouraged to apply early in their course of studies. Non-degree students must hold a bachelor's degree or equivalent with a 3.0 GPA.

Courses

WGSS 001 Gender and Society 4 Credits
The course introduces students to key concepts, theoretical frameworks, and interdisciplinary research in the field of Women's and Gender Studies. Examines how gender interacts with race, age, class, sexuality, etc., to shape human consciousness and determine the social organization of human society. The course may include topics such as: gender and work; sexuality and reproduction; women's health; media constructions of gender and race; gender, law, and public policy.
Attribute/Distribution: CC, SS, SW

WGSS 036 (REL 036) New Black Godz 4 Credits
From celebrity self-defining agents of material abundance (Jay Z) to those posthumously made gods after tragically succumbing to socially-sanctioned sacrifice (Breonna Taylor), "New Black Godz" explores black icons at the center and margins of promise and peril. Following hip hop and black expressive cultures' signifying on gods, we explore means/modes of black godz' creative manipulation of identity and social difference, and ingenuity of transmuting "problem" status into creative ingenuity at the crossroads of social mobility and the limits of escape.
Attribute/Distribution: HU

WGSS 050 (ASIA 050, MLL 050) Dreaming in Pre-modern China 4 Credits
Life is a cosmic allegory experienced by a group of all-too-human incarnated spirits of the 18th century novel Story of the Stone (aka Dream of the Red Chamber). A unique depiction on the inner emotional landscape of young women and the quest for identity by Precious Jade--is he a real boy? Read and discuss in English. Option to combine with CHIN 371 for those who wish to also read and research it in Chinese.
Attribute/Distribution: HE, HU, W

WGSS 091 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

WGSS 104 (ENGL 104) Special Topics in Gender Studies 4 Credits
This course will involve extended study in a sub-area of English language culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

WGSS 115 (ASIA 115, MLL 115) Sex, War, Women, Art 4 Credits
Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary women artists, and writings on sex workers, impacted by the Japanese empire. Students will be exposed to feminist theories in this course; taking WGSS001 is recommended prior.
Attribute/Distribution: CC, HE, HU, W

WGSS 121 (ART 121) Women in Art 4 Credits
A history of women artists from Renaissance to present day, with emphasis on artists of the 20th and 21st century from a global perspective. We explore attitudes toward women artists and their work as well as the changing role of women in art world. There may be required visits to museums and/or artists' studios.
Attribute/Distribution: CC, HE, HU

WGSS 124 (HIST 124) Women and Gender in US History 4 Credits
Roles of women in American society from colonial to present times : attitudes toward women, female sexuality, women's work, and feminism.
Attribute/Distribution: CC, SS, SW, W

WGSS 125 (HIST 125, HMS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. The class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: CC, HE, HU, W

WGSS 126 (AAS 126, HIST 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women's historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: CC, HE, HU

WGSS 127 (SOC 127) Sociology of Sexuality 4 Credits
Students in this course view human sexuality through a sociological lens. This includes theory, research methods, and topics such as LGBTQ identities, family formation, sex work, teenage sexuality, sadomasochism, and sexual technologies. We pay particular attention to ways in which sexual behavior is regulated, as well as social constructions of "the normal." Course material focuses on the United States, although students are encouraged to bring cross-national perspectives into papers and class discussions.
Attribute/Distribution: CC, SS, SW

WGSS 128 (SOC 128) Race, Gender and Work 4 Credits
Race, Gender and Work is a class designed to help students understand racial and gender inequalities as they relate specifically to work and employment. We explore the origins and histories of inequalities, the ways in which inequalities persist and/or change today, and what steps might be taken toward creating a more equal society.
Attribute/Distribution: SS

WGSS 129 (DES 129, THTR 129) History of Fashion and Style 4 Credits
Global trends in dress and culture from pre-history to today.
The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: CC, HE, HU

WGSS 131 (AAS 131, GS 131, HIST 131) Women, Gender, Sexuality and Race in African Societies 4 Credits
This course explores the various ways in which womanhood, gender, sexuality and race are defined, constructed and articulated in African societies. The interdisciplinary course draws from historical writings, novels, biography, anthropology, political science, health and other fields to examine diverse activities and contributions of African women from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

WGSS 132 (ENGL 132, FILM 132) Viewing Mad Men: Window, Mirror, Screen 4 Credits
Widely considered one of the best TV shows ever made, Mad Men demonstrated that television serial drama could combine virtuoso storytelling, cinematic visual style and historical ambition. Set in a New York ad agency in the 1960s, Mad Men both opens a window onto the past and holds a mirror up to the present. We will analyze Mad Men's innovative visual and narrative style and explore two core themes: shifting gender roles and the influence of advertising in U.S. society.
Attribute/Distribution: HE, HU

WGSS 135 (ASIA 135, MLL 135) POWER, (WO)MEN, SILENCE 4 Credits
What do women say in their writings when their voices are silenced? How does silence speak to you? How do gender, sexuality, class, and power articulate one another? Through the study of selected short stories, novels, films, and anime, this course examines various voices, cultures, histories, and societies in Japan. No prior knowledge of Japanese language is required. An introductory course taught in English.
Attribute/Distribution: HE, HU, W

WGSS 138 (JST 138, REL 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women's memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children's literature, among others.
Attribute/Distribution: CC, HE, HU, W

WGSS 146 (PHIL 146) Philosophy of Sex and Gender 4 Credits
An examination of concepts, values, and assumptions relevant to gender and sex(uality) in our diverse society, investigating how they affect our lives in both concrete and symbolic ways. Intersections among gender, sex(uality), race, class, religion, ethnicity, etc., will be explored. Special attention will be paid to how gendered assumptions color our understandings of experiences of embodiment and emotion, reasoning and decision-making, knowledge production, and public and private relationships and activities.
Attribute/Distribution: CC, HE, HU

WGSS 147 (ENGL 147, FILM 147) Made to Kill: Female Violence in Popular Film 4 Credits
Heroes. Monsters. Outlaws. Catsuits. In the wake of the second-wave feminist movement, U.S. films in the horror, thriller, and action/adventure genres began to represent women as perpetrators of violence more frequently and in new ways. This course examines how iconic films from the last four decades, such as The Silence of the Lambs, Alien, The Hunger Games and Wonder Woman, have both reflected and shaped the ongoing cultural debate about gender, sexuality and power.
Attribute/Distribution: HE, HU

WGSS 149 (ENGL 149, FILM 149) Sexbots and Terminators: Cinematic Fantasies of the Intelligent Machine 4 Credits
For decades, film and television narratives have represented human relationships with robots to explore existential issues in human life: love, sex, mortality, labor, domination, exploitation. Could robots solve the difficulties of human intimacy? Could artificial intelligence enable us to cheat death? What do sex robots reveal about misogyny? Why are human/AI relationships so frequently imagined in Western narratives as master/slave relationships? Films and TV shows may include The Matrix, Ex Machina, Her, Terminator 2, Black Mirror and Westworld.
Attribute/Distribution: HE, HU, W

WGSS 154 (ENGL 154, FILM 154) What Does Creativity Look Like? Documentary Visions 4 Credits
What can documentary films tell us about creativity? What is it and why does it matter? This course takes an intersectional approach to creativity, centering the role of gender, sexuality, race and class in the lives and work of the artists and activists represented in the course films. We will also analyze the creative visual and narrative strategies these documentaries employ to shape the stories they tell. Students will have an opportunity to document the creativity of their own communities.
Attribute/Distribution: HE, HU

WGSS 164 (AAS 164, SOC 164) Sociology of Black Families 4 Credits
The objective of this course is to help students learn more about Black family experiences within the United States and globally. In approaching the course with an intersectional lens, students will learn about the varied experiences of Black families, and the ways in which these experiences are embedded in empowerment, disempowerment, and self-actualization. Students will leave the course understanding Black families at the intersection of fatherhood, motherhood, marriage, singlehood, childrearing, LGBTQ families, interracial families, transnational families, and aging.
Attribute/Distribution: CC, SS, SW

WGSS 173 (ASIA 173, REL 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S..
Attribute/Distribution: CC, HE, HU, W

WGSS 179 (POLS 179) Politics of Women 4 Credits
Selected social and political issues relating to the role of women in American society. Focuses on such questions as economics equality, poverty, and work roles, the older woman, gender gap, political leadership, reproduction technology, and sexual violence.
Attribute/Distribution: SS

WGSS 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs.
Repeat Status: Course may be repeated.
Attribute/Distribution: AL, CC, HE, HU, SS, SW, W

WGSS 210 (AAS 210, POLS 210) Revolution on Campus 4 Credits
Universities are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.
Attribute/Distribution: CC, SS, SW

WGSS 226 (PHIL 226) Feminism and Philosophy 4 Credits
Analysis of the nature, sources, and consequences of the oppression and exploitation of women and justification of strategies for liberation. Topics include women's nature and human nature, sexism, femininity, sexuality, reproduction, mothering. Student must have completed at least one Philosophy course at the 100-level, or one course in Women, Gender, and Sexuality Studies.
Attribute/Distribution: HU

WGSS 256 (ASIA 256, HIST 256, MLL 256) Women in Pre-Industrial China 4 Credits
This seminar focuses on the role of women as defined by medical, philosophical, legal, historical, religious, literary and other Chinese texts from ancient through early modern times. Attention is how women contributed to the evolution of traditional Chinese civilization and culture. The course materials are in English.
Attribute/Distribution: HE, HU, W

WGSS 260 (ISE 260) Algorithms and Social Justice 4 Credits
This course explores how algorithms reflect and magnify social inequality. Topics include race, gender, sexuality, and class in the context of policing and punishment, search engines and social media, and ranking and optimization. Readings, discussions, and assignments are designed to cultivate transdisciplinary competence in the history of science and technology, feminist theory, machine learning, and artificial intelligence, and to encourage peer-to-peer learning across the humanities, social science, and engineering.

WGSS 271 Independent Reading and Research 1-4 Credits
Independent study of selected topics designated and executed in close collaboration with a member of Women, Gender, and Sexuality Studies faculty. May be repeated for elective credit. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

WGSS 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

WGSS 300 Apprentice Teaching 1-4 Credits
Supervised participation in various aspects of the teaching of a course. Transcript will identify department in which apprentice teaching was performed. Consent of department chairperson and permission of the Dean. The transcript will reflect the subject area in which the teaching was done.
Repeat Status: Course may be repeated.

WGSS 303 (ENGL 303, FILM 303, GERM 303, MLL 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: CC, HE, HU, W

WGSS 304 (ENGL 304) Special Topics in Gender Studies II 3,4 Credits
This course will involve extended study in a sub-area of English language, culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HE, HU, W

WGSS 311 (ENGL 311) Representations of Gender and Sexuality 3-4 Credits
This course explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. How do female and male writers envision what it means to be a "woman" or to be a "man" at various moments in history and from various places around the world? How have gendered (and sexed) identities been shaped in various constraining and empowering ways in the literary imagination? What specifically gendered issues (such as love and violence) have been represented in literature?
Repeat Status: Course may be repeated.
Attribute/Distribution: HE, HU, W

WGSS 322 (AAS 322, HIST 322) African Women, Voices and Lives 3-4 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.
Attribute/Distribution: CC, HE, HU, W

WGSS 325 (HIST 325, SOC 325) History of Sexuality and the Family in the U.S. 3-4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post-World War II era. Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.
Attribute/Distribution: CC, SS, SW, W

WGSS 326 (LAS 326, SPAN 326) Tradition and Resistance: Women Writers of Latin America 4 Credits
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, Cristina Peri Rossi, among others.
Prerequisites: SPAN 152
Attribute/Distribution: CC, HU, W

WGSS 327 (FREN 327) Women Writing in French 4 Credits
Reading and discussion of works written by women in French. The emphasis is on 19th and 20th Century writers, such as G. Sand, Colette S. de Beauvoir, M. Duras, Andrée Chédid.
Attribute/Distribution: HU

WGSS 330 Internship in Women, Gender and Sexuality Studies 1-4 Credits
Supervised work in women's organizations or settings, combined with an analysis, in the form of a major paper, of the experience using the critical perspectives gained in WGSS courses. Placements arranged to suit individual interests and career goals; can include social service agencies, women's advocacy groups, political organizations, etc. Consent of program director required.
Repeat Status: Course may be repeated.
Prerequisites: WGSS 001
Attribute/Distribution: CC, SS, W

WGSS 331 (GS 331, SOC 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: CC, SS, SW, W

WGSS 334 (HMS 334, PSYC 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.
Attribute/Distribution: SS

WGSS 342 (GS 342, POLS 342) Gender and Third World Development 3-4 Credits
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect 'real people?' How do economic theories affect men vs. women? What is the role of people who want to 'help?' Some background in economic theories and/or Third World politics desired, but not required.
Prerequisites: POLS 001 or WGSS 001
Attribute/Distribution: SS

WGSS 344 (SOC 344) Bad Girls: Gender, Sexuality, Deviance 4 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss readings in the context of current events and popular culture.
Attribute/Distribution: CC, SS, SW, W

WGSS 345 (ENGL 345) Women and Revolution in Early America 3-4 Credits
This course explores how opportunities and possibilities for women transformed (or remained the same) during the long eighteenth century. Which early American women could participate in public life and under what circumstances? Did early American values such as liberty and independence extend to women—and to which women? Which women, if any, felt like they had a "revolution" in 1776? Captivity narratives, poetry, novels, and other public writing by early American women will help us explore these issues.
Attribute/Distribution: CC, HE, HU, W

WGSS 349 (POLS 349) Greed: Social Policy for Profit 4 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity strucures.

WGSS 350 Seminar in Feminist Theory 4 Credits
An upper-level seminar serving as a capstone experience that challenges students to systematize insights gained from introductory and elective courses through the more deeply analytical lens of feminist theory. Consent of program director.
Prerequisites: WGSS 001
Attribute/Distribution: CC, W

WGSS 361 (ENGL 361) Jane Austen 3-4 Credits
This course explores the writings, culture, and afterlives of Jane Austen, often considering the interrelations of Austen's novels with various adaptations and variations of her stories. Students explore the efficacy, complexity, and social impact of Austen's works through a variety of critical approaches to ask different questions about slavery and abolition, the French Revolution, British imperialism, and women's equality.
Attribute/Distribution: HE, HU, W

WGSS 363 (ENGL 363) Gender and Sexuality in Early Modern Poetry 3-4 Credits
In sixteenth- and seventeenth-century England, poetry was a culturally significant literary form in which authors explored a range of pressing issues. Our readings will be drawn from canonical and non-canonical authors, and we will pay attention to how poetic form intersects with explorations of gender and sexuality. This study of gender and sexuality in the poetry of one historical period will enable us to think more broadly about how literary texts participate in—and help to shape—social and cultural norms.
Attribute/Distribution: CC, HE, HU, W

WGSS 364 (SOC 364) Sociology of Families 4 Credits
Sociological analysis of families in the United States, including investigations of historical and contemporary patterns. Issues addressed include parenting, combining work and family, divorce and remarriage, family policies.
Attribute/Distribution: CC, SS, SW, W

WGSS 365 Inequalities at Work 4 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace. The course will be conducted seminar-style and the class will rely heavily on student participation.
Attribute/Distribution: SS

WGSS 369 (ASIA 369, GS 369, POLS 369) Women's Movement in China 4 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, “did the Party liberate women?”
Attribute/Distribution: SS

WGSS 373 Internship On-Campus 1-3 Credits
Supervised work in on-campus student services office such as the Center for Gender Equity, the Pride Center, Office of Gender Violence, etc, allows WGSS students to bring critical perspectives on women and gender into the campus community. This course may be repeated for credit up to a maximum of 6 credits. Prerequisites: WGSS 001 and consent of the Center director and WGSS director. Pre-req of WGSS 001 may be waived for internship with Pride Center with consent of Center director.
Repeat Status: Course may be repeated.
Prerequisites: WGSS 001
Attribute/Distribution: CC, SS, W

WGSS 380 (HMS 380, POLS 380) The End of Policing? Politics of Social Control 4 Credits
"What are your prime directives? Serve the public trust, protect the innocent, uphold the law" (Robocop 1987). This course focuses on policy design and feedback and is not a course on police procedure or policing tactics. The primary objective of the course is to learn to think critically about public safety and evaluate policies based on their value to democracy.
Attribute/Distribution: CC

WGSS 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, HU, SS, W

WGSS 393 (AAS 393) Black Feminist Thought and the Media Industries 4 Credits
From the Oscar-winning documentary 20 Feet from Stardom to Lifetime’s investigative series Surviving R.Kelly, recent media highlights injustices faced by black women in the media industries. This course historicizes the place of black women within media, introduces students to Black Feminist Thought, and unpacks concepts such as hypervisibility, intersectionality, and womanism. It explores how race and gender manifest in (and are challenged by) the creative industries. Course fills major and minor requirements in AAS and WGSS.
Attribute/Distribution: SS

WGSS 399 Senior Thesis 2-4 Credits
Research during senior year culminating in a senior thesis. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: CC, W

WGSS 403 (MLL 403) Grimms' Fairy Tales: Folklore, Feminism, Film 3 Credits
This intercultural history of the Grimms' fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany as well as Europe and America. Versions of "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in films and many forms of world literature. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.

WGSS 411 (ENGL 411) Gender and Literature 3 Credits
This seminar explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. Content changes each semester.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 422 (AAS 422, HIST 422) African Women, Voices and Lives 3 Credits
This course traces the changing history and status of African women. It positions their voices and biographies at the center of broader narratives that often perceive them as powerless, emerging from a lineage of poverty and oppression, and without agency. What happens when African women speak for themselves? We will explore the intersections of gender, class, race, and power to emphasize how women have been instrumental in shaping African history from the pre-colonial period to the present.

WGSS 430 Internship in Women, Gender and Sexuality Studies 1-3 Credits
Internship related to women, gender, and sexuality studies. Supervised by WGSS faculty. Consent of program director required.

WGSS 449 (POLS 449) Greed: Social Policy for Profit 3 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity strucures.

WGSS 450 Seminar in Feminist Theory 3 Credits
A graduate seminar providing foundational study of multidisciplinary theoretical frameworks of women, gender, and sexuality studies.
Attribute/Distribution: HU, ND

WGSS 458 (HIST 458) Readings in Gender History 3 Credits
Study in small groups under the guidance of a faculty member on the literature of an issue, period, country or culture within gender history.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 465 Inequalities at Work 3 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace.
Attribute/Distribution: SS

WGSS 469 (POLS 469) The Women's Movement in China 3 Credits
We will examine the state-sponsored, state-directed mass movement for the liberation of Chinese women. Beginning with Confucian notions of mother/daughterhood, to imperial system, to the role of women in the founding and establishment of the Communist Party of China, to the participation of women and girls in the Great Proletarian Cultural Revolution. Gender equality issues have been a central focus of the Party. The class will look at post-reform era women's status and ask, “did the Party liberate women?”

WGSS 491 Independent Study 3 Credits
Individually supervised course in area of women, gender, and sexuality studies not ordinarily covered in regularly listed courses. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 493 (AAS 493) Black Feminist Thought and the Media Industries 3 Credits
From the Oscar-winning documentary 20 Feet from Stardom to Lifetime's investigative series Surviving R.Kelly, recent media highlights injustices faced by black women in the media industries. This course historicizes the place of black women within media, introduces students to Black Feminist Thought, and unpacks concepts such as hypervisibility, intersectionality, and womanism. It explores how race and gender manifest in (and are challenged by) the creative industries. Course fills major and minor requirements in AAS and WGSS.

College of Business

Manoj K. Malhotra, Dean; Naomi Rothman, Associate Dean and Director, Undergraduate Programs; Xiaosong (David) Peng, Associate Dean, Graduate Programs; Paul Brockman, Senior Associate Dean for Faculty and Academic Affairs; Marietta Peytcheva, Chair, Department of Accounting; Chad Meyerhoefer, Chair, Department of Economics; McKay Price, Chair, Perella Department of Finance; Andrew Ward, Chair, Department of Management; K. Sivakumar, Chair, Department of Marketing, Zach Zacharia, Interim Chair, Decision and Technology Analytics (DATA) Department.

The College of Business offers a Bachelor of Science degree in business and economics. In the dynamic global environment of the 21st Century, today's business students face unprecedented challenges. Lehigh's College of Business prepares them to meet these challenges and to succeed. The mission of Lehigh University's College of Business is to provide an intellectual and professional learning environment that advances knowledge through research and scholarship and that develops future leaders through experiential learning, rigorous analysis, and the discipline of a strong work ethic – the hallmarks of a Lehigh University business education.

The College of Business consists of six departments: accounting, decision and technology analytics (DATA), economics, Perella Department of Finance, management, and marketing. Its programs, accredited by the AACSB International—The Association to Advance Collegiate Schools of Business—provide students with a solid foundation in business and economics principles. In addition to the traditional undergraduate majors of accounting, economics, finance, management, and marketing, the College offers innovative programs and courses that respond to today's unique business requirements, including:

The Business Information Systems major answers a recognized need in the business world. As businesses seek to make themselves more productive and competitive, they have become more reliant on information technology. Students with a good understanding of information systems can help businesses enhance their use of this technology.

The Supply Chain Management major is another response to the complex environment facing business graduates. This undergraduate major gives students solid exposure to supply management, logistics, business-to-business marketing and operations management.

The Business Analytics major is to prepare students for today's data-driven world by imparting knowledge and developing skills that students need to collect, integrate, and analyze data and interpret results to support business decisions and process improvements.

The College of Business has joined with the College of Engineering to offer two cross-college programs. These programs, Integrated Business and Engineering (IBE) and Computer Science and Business (CSB), are described in full in the following "Crossing Boundaries" section.

All minors offered by the College of Arts and Sciences are available to College of Business undergraduate students. The engineering minor offered by the College of Engineering is also available to all College of Business undergraduates. The following College of Business minors are available to College of Business students: business information systems, supply chain management, management, and financial technology (FinTech).

In order to declare a College of Business minor, students must first have a College of Business declared major. There is no overlapping credit between College of Business major and College of Business minor courses or between College of Business minors.

BREAK BOUNDARIES

As technology and business march ahead together, opportunity abounds for institutions of higher learning. The business makers of tomorrow are groomed in the classrooms of today. Seeking brilliance and purpose, our students explore, evolve and expand new thinking. Our college is a research-based institution that pioneers interdisciplinary learning and fosters the hard-working practical skills employers covet. And our careers are raised ever higher by the adventurous ingenuity Lehigh cultivates. Across disciplines, geographies, and ideologies, we see boundless possibilities. We are the students, alumni, professors, and friends of the Lehigh College of Business, and we break boundaries.

Entrepreneurship Minor

The program aims to prepare students from all undergraduate colleges at Lehigh with the skill sets, attitudes, and understanding of the processes to realize their entrepreneurial goals in either an emerging or established company setting. The program is designed to be generally accessible to students from all disciplines with an emphasis on innovation, the entrepreneurial process, and cross-functional integration. The minor can be added to any undergraduate degree at the university.

Real Estate Minor

The real estate program is designed to complement a wide range of majors, from art and architecture to civil engineering to environmental science to finance to marketing to economics. Students must take five courses comprised of both required and elective components which draw from several academic disciplines across campus. The program is housed in the Goodman Center for Real Estate and is open to undergraduate students of all majors.

Career Placement

The undergraduate programs in the College of Business provide the students with a strong foundation in business and economic principles necessary for success in business. Upon graduation, the majority of students from the College of Business enter business in many different professional positions, including accounting, investment banking, advertising, marketing, management consulting, and information systems. Further professional studies in law, graduate business schools, or specialized graduate education in economics, operations research, or other related fields are additional options open to graduates.

A required Student to Professional Co-Curriculum facilitates undergraduate preparation for the competitive job landscape.

Variety of Options

While preparing students for a career in business and economics, we recognize the importance of a well-rounded individual. At Lehigh, this important exposure to science, language, and the arts and humanities is accomplished by distribution requirements, within which the student has wide choice. Students take 48 credits outside the College of Business.

The Bachelor of Science in Business and Economics may also lead to admission into the Master of Business Administration program at Lehigh or another institution after graduates have at least 2 years of work experience. In addition, the college also offers the following graduate degrees: Doctor of Philosophy, Master of Business Administration and Engineering, Master of Business Administration and Educational Leadership, Master of Science in Business Analytics, Master of Science in Financial Engineering, Master of Science in Applied Economics, and Master of Science in Management.

BACHELOR OF SCIENCE IN BUSINESS AND ECONOMICS

The College of Business at Lehigh University prepares students to become business and community leaders in a broad range of organizations. Our undergraduate students acquire the knowledge and skills needed to excel in business. Overall, we expect our graduates to be able to successfully solve complex, unstructured business problems.

For the bachelor of science degree in business and economics, 124 credit hours are required. A writing requirement, which is included

within the required 124 credit hours, is also a part of the college curriculum.

Planning Courses of Study

First Year	CR
WRT 001 or 003	3
MATH 021 or 081	4
ECO 001	4
BUS 001	1
ECO 045	3
BUS 003	1.5
MGT 043	3
BUAN 044	1.5
	21
Second Year	**CR**
ACCT 151	3
ACCT 152	3
BIS 111	3
ECO 146 or 119	3
FIN 125	3
MKT 111	3
SCM 186	3
	21
Third Year	**CR**
LAW 201	3
BUS 203	1.5
MGT 243	3
BUAN 244	1.5
	9
Fourth Year	**CR**
MGT 301	3
	3

Total Credits: 54

Major Programs (15 credits - 23 credits)

By the end of the second semester of the sophomore year, students select a major consisting of sequential or related courses in one of the following major programs: accounting, business information systems, economics, finance, management, marketing, and supply chain management. A GPA of 2.0 or higher in the major program is required for graduation.

Double Majors

Students in the College of Business may pursue a double major within the college according to college guidelines, which include the requirements of each of the majors and a minimum of 10 courses (30 credits) between the two combined majors. Students must declare a single major prior to declaring a second major. Students planning to pursue a second major within the College of Business must meet a prerequisite GPA of 2.0 or higher.

Globalization and Diversity Requirements

Each student must complete a minimum of 3 credits in Diversity and 3 credits in Globalization. These courses may simultaneously fulfill other College of Business degree requirements.

Electives (52-55 credits) - depending on major

Students will earn 52-55 credits of electives. A minimum of 48 credits are to be taken outside the College of Business.

Students are required to take six (6) credits of humanities (HU), six (6) credits of social science (SS), and three (3) credits of science (NS) for a total of 15 credits of distribution requirements. Students should refer to the department in the catalog to determine which course offerings may be taken to satisfy these requirements.

In the College of Business, the pass-fail option is available for elective courses only. A student desiring Lehigh credit for a course taken at another institution must complete a transfer credit form and obtain approval from the appropriate Lehigh academic department in advance.

BUSINESS CERTIFICATE PROGRAMS

Business Analytics Certificate

Today's business environment challenges firms to use data as a driver in decision-making. All sectors of business are bursting with information that needs to be structured and analyzed in order to form meaningful insights. Upon completion of the certificate, students will:

- Understand the field of data science with an understanding of three distinct areas: predictive (forecasting), descriptive (business intelligence and data mining), and prescriptive (optimization and simulation)
- Apply data analytic tools in different business disciplines to formulate and solve business problems
- Demonstrate an understanding of fundamental computer programming constructs and concepts
- Understand how data is collected, prepared, stored, analyzed, modeled, and visualized for analytical business analysis and decision making

The Business Analytics Certificate is a 12-credit program that includes a mix of courses related to business analytics designed to give students exposure to computer programming, business intelligence, computer models, and data management in order to foster decision making in the modern enterprise. The certificate is open to all College of Business students, including CSB and IBE. To earn the certificate, students will take at least 12 credits and earn a grade of "C-" or higher in each course.

For a program overview with course information, please visit the College of Business website.

International Business Certificate

The International Business (IB) Certificate is intended to benefit those students seeking to broaden their understanding of international business and foster the development of their global mindset. The program encompasses a mix of courses relating to international business and management, courses designed to broaden a student's functional knowledge and or cultural competencies, and requires participation in a global immersive experience. The IB Certificate is open to all undergraduate students from any major with the approval from the Directors of the IB Certificate Program. Students are required to complete a minimum of 12 credits and participate in an immersive global experience.

Students are required to take at least one (1) of the following two (2) courses:

- MGT 346 International Business
- MGT 342 Managing in the International Organization

To successfully complete the program, students must take at least one other approved College of Business course and then any combination of qualifying business or non-business courses to reach the 12-credit hour requirement. To count toward the IB Certificate, the content of courses must be highly salient to international business, and the student must obtain a grade of "C-" or higher. Exemplars of international business-related courses, as well as qualifying global experiences, can be found on the College of Business website.

BUSINESS MINOR

The purpose of the business minor program is to enable non-business students to pursue a course of business studies which enables them to supplement their major studies and enhances their career options upon graduation. The overall learning objective of the program is to provide non-business students with the knowledge and skills with which to make more informed business decisions.

Courses offered in the business minor program are not open to students currently in the College of Business, nor may these classes count as substitutes for College of Business core classes should a student later decide to transfer into the College of Business.

Program of Studies

The business minor consists of 14 credit hours. The courses are integrated across the entire program and must be taken in a stepped sequence. These 14 credit hours plus the prerequisite consist of the following courses:

Required prerequisite course

ECO 001 – Principles of Economics (4) ECO 001 can be taken in either the freshman or sophomore year and must be completed prior to entering the Business Minor Program.

Required courses

First Year			
Fall	**Credits**	**Spring**	**Credits**
BUS 125	1	BUS 127	3
BUS 126	3		
	4		**3**
Second Year			
Fall	**Credits**	**Spring**	**Credits**
BUS 275	3	BUS 276	3
		BUS 326	1
	3		**4**

Total Credits: 14

Recommended courses

The courses required in the business minor program will be offered in a stepped sequence requiring completion of each course in the sequence before being able to continue to the next course. That is, students must first complete BUS 126 before taking BUS 127, BUS 127 before taking **BUS 275**, and **BUS 275** before taking **BUS 276**. BUS 125 and BUS 326 are to be taken in conjunction with BUS 126 and **BUS 276** respectively.

Program admission requirements

Each spring, approximately 100 students will be accepted into the business minor program for the following fall. Applications to the program will be made by students and submitted to the program director by the last Friday in January. An admissions committee comprised of the business minor program director and the business minor curriculum committee will make admission decisions based on G.P.A., experience, and interest in pursuing business opportunities upon graduation from Lehigh (to be evaluated on the basis of a written essay). Students will be notified of admissions decisions by the first week in March to begin registration for the fall semester. Applications are restricted to students from the P.C. Rossin College of Engineering and Applied Science, the College of Arts and Sciences, and the College of Health only. The Director of the Business Minor program is Robert Kuchta, Teaching Full Professor, Department of Management, 330 Rauch Business Center (rok8@lehigh.edu).

GRADUATE PROGRAMS

Graduate degree programs (p. 291) offered by the college include the Master of Business Administration, the Master of Science in Applied Economics, the Master of Science in Business Analytics, the Master of Science in Management, and the Ph.D. in Business and Economics.

Interdisciplinary degree programs (p. 507) are offered through partnerships with other colleges:

- P.C. Rossin College of Engineering and Applied Science - Master of Business Administration and Engineering joint degree
- P.C. Rossin College of Engineering and Applied Science and the College of Arts and Sciences-Master of Science in Financial Engineering
- College of Education-Master of Business Administration and Educational Leadership joint degree
- College of Health-Master of Business Administration and Master of Public Health, dual-degree option.

Dual Degree Programs (https://business.lehigh.edu/academics/graduate/masters-programs/dual-degree/) are available through the College of Business

- MS in Business Analytics with MS in Applied Economics (enroll in programs in any order)
- MS in Management with MS in Business Analytics or MS in Applied Economics (must enroll in MS in Management first)

The Accelerated 4+1 MS in Financial Engineering Program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/accelerated-program/) may allow the completion of the master's degree in Financial Engineering in a one-year timeframe. Undergraduate students indicating interest are paired with program advisors who guide them through the completion of prerequisite work during undergraduate study. Undergraduates with room in their schedules may have the opportunity to take and reserve graduate-level courses during their undergraduate study, thus saving time and funds.

Accounting

The Department of Accounting provides a variety of courses to support the College of Business core requirements and to provide an undergraduate major.

The mission of Lehigh University's Accounting Department is to provide outstanding accounting education and networking opportunities that prepare students (1) to enter the accounting profession upon graduation, (2) to assume positions of leadership in the global business community later in their careers, and (3) to be socially responsible and ethical business professionals. We will also advance the profession of accountancy globally to serve the public interest by producing and disseminating original accounting research and cross-disciplinary scholarship. We are guided by the missions of Lehigh University and the College of Business. The Accounting Department continuously seeks to be recognized as one of a select group of programs in the United States where an educational experience of the highest possible quality is obtainable.

Within the undergraduate accounting major, students explore and prepare for various career opportunities within the broad field of accounting: Public Accounting Assurance and Tax Services, Financial Services and Corporate Accounting, and Information Systems. The Accounting Program recognizes the learning objectives set forth by the College of Business as an integral part of the curriculum, as well as the importance of providing students with a strong foundation in liberal arts, humanities, and science as set out in the College of Business core curriculum. In addition to the College of Business core curriculum, the accounting curriculum is designed to foster the following learning objectives:

- Preparing and understanding general purpose financial statements for parties outside the firm.
- Using accounting information for decision-making inside the firm.
- Understanding the information systems governing the flow of and control over financial information inside the firm.

To the extent that the above objectives are achieved, Accounting graduates will be well-prepared for positions in public accounting, industry, not-for-profit organizations, and graduate school. Although preparation for professional examinations is not a primary objective, graduates will have the background to take professional examinations in accounting.

THE ACCOUNTING MAJOR

The undergraduate program in accounting is accredited by AACSB International. This achievement places the program within a small group of schools which have satisfied a rigorous examination of the program, faculty, and students that extend beyond the accreditation standards applied to the entire College of Business undergraduate and graduate programs.

Sophomore Prerequisites to the Major [1]		
ACCT 151	Introduction to Financial Accounting	3
ACCT 152	Introduction to Managerial Accounting	3
Total Credits		**6**

[1]

ACCT 151 & 152 are a part of the Business Core and thus are not used as a part of the major GPA calculation.

Accounting Major Requirements (Core and Concentration)		
Core Requirements, typically taken junior year		
ACCT 315	Intermediate Accounting I	3
ACCT 316	Intermediate Accounting II	3
ACCT 311	Accounting Information Systems	3
ACCT 324	Advanced Managerial Accounting	3
Concentration, typically taken senior year		
Concentration, three courses, one of which is accounting (see below)		9
Total Credits		**21**

CONCENTRATIONS

Public Accounting Assurance and Tax Services		
This concentration is suited for students interested in entering public accounting.		
ACCT 307	Fundamentals of Federal Income Taxation	3
ACCT 320	Fundamentals of Auditing	3
ACCT 317	Advanced Financial Accounting	3
Total Credits		**9**

Financial Services and Corporate Accounting		
This concentration may appeal to students seeking accounting positions at financial services firms and industrial corporations. For some time representatives from these companies have sought Lehigh students with a strong accounting background. External constituencies suggest that a dose of finance will strengthen these students and make them even more attractive.		
FIN 323	Investments	3
FIN 328	Corporate Financial Policy	3
ACCT 318	Analysis of Financial Statements	3
Total Credits		**9**

Information Technology		
Public accounting firms seek graduates for the rapidly growing area of global risk management (GRM). Students entering GRM will be responsible for assessing accounting system and computer risks that impact the financial statements of the organization and for evaluating internal controls in place to minimize such risks. Their findings become an important element in the conduct of the financial audit. This new career path thus requires students who possess strong systems skills and an understanding of financial accounting, management accounting, and auditing. Taxes and advanced financial accounting topics are less important in this setting. Therefore, the following courses comprise this concentration.		
ACCT 320	Fundamentals of Auditing	3
ACCT 330	Accounting Data and Analytics	3
One 300-level BIS course		3
Total Credits		**9**

Course descriptions for the College of Business graduate courses can be found under Business Graduate courses (p. 291).

Courses

ACCT 001 Segal Accounting Distinguished Speaker Series 1 Credit
The Segal Accounting Distinguished Speaker Series introduces students to current accounting issues from the perspectives of distinguished thought leaders in the accounting profession. Students will have the opportunity to network with prominent accounting professionals who are leaders in public accounting firms, industry, government, regulatory bodies, and non-profit organizations. This course is open to all accounting majors as well as first- and second-year College of Business students who are interested in exploring career opportunities in accounting.
Repeat Status: Course may be repeated.

ACCT 108 Fundamentals of Accounting 3 Credits
A one-semester survey of accounting principles and practices designed for those students which includes an introduction to industrial cost systems designed for those non College of Business students planning to take only one accounting course. Other students should take the Acct 151-152 sequence.

ACCT 151 Introduction to Financial Accounting 3 Credits
The organization, measurement and interpretation of economic information. Introduction to accounting theory, concepts and principles, the accounting cycle, information processing, and financial statements. Exposure to controversial issues concerning income determination and valuation. Must have sophomore standing.

ACCT 152 Introduction to Managerial Accounting 3 Credits
An introduction to internal accounting information for all levels of management. Topics include cost flow in a manufacturing operation; planning, evaluating and controlling through budgeting and standard costing; and decision-making using cost-volume-profit analysis, direct costing, and relevant costs.
Prerequisites: ACCT 151

ACCT 307 Fundamentals of Federal Income Taxation 3 Credits
An introductory study of the principles and concepts of federal income taxation of individuals, corporations, partnerships, and fiduciaries; and federal gift and estate taxes. Determination of tax liabilities and opportunities for planning are emphasized. Problem-solving using the source materials of tax law and tax research are important components of the course.
Prerequisites: ACCT 151

ACCT 309 Advanced Federal Income Taxation 3 Credits
An advanced study of the taxation of business organizations, estates, trust, and wealth transfer taxes. Planning and research are the basic components of the course. Problem-solving and written research are emphasized.
Prerequisites: ACCT 307

ACCT 310 Essential Tax Planning for Business Strategies 3 Credits
Designed for all business majors, regardless of prior tax knowledge, seeking to enhance client value by understanding the tax implications of their transactions. The course covers federal and state tax policy, planning, and compliance, and explores the key tax aspects of entity selection, financing, structuring (including investment banking and private equity considerations), securities, real estate holdings, and personal wealth management. Ideal for finance majors preparing for Series exams and accounting majors seeking CPA exam readiness.
Prerequisites: ACCT 151 and FIN 125
Can be taken Concurrently: FIN 125

ACCT 311 Accounting Information Systems 3 Credits
An introduction to the concepts underlying information systems as they relate to organizational structure, managerial decision making and accounting. The course acquaints students with the reports and documents generated by information systems, as well as procedures and controls employed in a variety of business applications. Students apply these concepts, techniques and procedures to the planning, analysis and design of manual and computer-based information systems. The course is also open to sophomores with the appropriate prerequisites.
Prerequisites: ACCT 152 and BIS 111

ACCT 315 Intermediate Accounting I 3 Credits
Intensive study of the basic concepts and principles of financial accounting, emphasizing the problems of fair presentation of an entity's financial position, operating results and cash flows. Understanding of the conceptual framework of accounting, review of the accounting process, and recognition, measurement, valuation and disclosure of current assets, fixed assets, and intangibles. Problem-solving skills and critical analysis are stressed. The course is also open to sophomores with the appropriate prerequisites.
Prerequisites: ACCT 152

ACCT 316 Intermediate Accounting II 3 Credits
The sequel to Accounting 315, this course continues with intensive study of recognition, measurement, valuation and disclosure issues relating to such topics as investments, liabilities, leases, pensions, income-taxes, share-based payments, revenue issues, earnings per share, and complexities related to the statement of changes in financial position. Analysis and interpretation of financial statements and problem-solving skills are integral parts of the course. The course is also open to sophomores with the appropriate prerequisites.
Prerequisites: ACCT 315

ACCT 317 Advanced Financial Accounting 3 Credits
A study of specialized topics in financial accounting, including partnership accounting, business combinations and consolidated financial statements, segment and interim reporting, foreign currency transactions and translation, and accounting and reporting for governmental and other nonprofit organizations. Involves considerable problem-solving and critical evaluation of controversial theoretical issues.
Prerequisites: ACCT 316

ACCT 318 Analysis of Financial Statements 3 Credits
This course uses financial statement information to analyze companies' profitability and risk. Understanding the form, content and relationships among the financial statements is integrated with the use of ratios and analytic adjustments to augment the information in published financial reports. Current developments, business strategies and off-balance-sheet financing are linked to assessments of companies, performance. Case studies, team projects and presentations involve actual companies, financial statements. Open only to graduating seniors.
Prerequisites: ACCT 316
Can be taken Concurrently: ACCT 316

ACCT 320 Fundamentals of Auditing 3 Credits
An introduction to auditing theory, objectives, and practices related largely to the responsibilities of independent professional accountants. The auditing environment, generally accepted auditing standards, internal control theory, and reporting alternatives are considered. Exposure to operational auditing is provided.
Prerequisites: (ACCT 311 or CSB 311) and (ACCT 315)

ACCT 324 Advanced Managerial Accounting 3 Credits
An in-depth study of cost concepts appropriate for product costing in a manufacturing operation, planning and controlling routine operations, and nonroutine decision-making. Topics include job order and process costing, joint and by-products, cost allocation, budgeting, standard costing, direct costing, cost-volume-profit analysis, and relevant costs for decisions. The course is also open to sophomores with the appropriate prerequisites.
Prerequisites: ACCT 152

ACCT 330 Accounting Data and Analytics 3 Credits
This course uses publicly available financial statement information to programmatically analyze company activities. Obtaining, cleaning, exploring, analyzing with statistical and machine learning methods, and presenting accounting data are explored in a project based format. Non-financial related information analyses are linked to audit and risk assessments. Projects and papers involve actual entities and associated financial information. Credit will not be given for both ACCT 330, Accounting Data and Analytics and MACC 430, Data Analytics for Accountants.
Prerequisites: ECO 045

ACCT 340 Investment Banking and Capital Markets Accounting 3 Credits
Achieving the objectives of complex finance transactions designed and executed on Wall Street requires consideration of specific accounting, financial reporting and tax requirements. Students majoring in finance, particularly those pursuing internships or careers in investment banking, consulting and related corporate finance fields, or the CFA certification, will benefit from enhancing their accounting knowledge in these areas. This class is specifically designed to provide finance majors with fundamental knowledge of the accounting and reporting implications for complex corporate transactions.
Prerequisites: ACCT 151 and FIN 125

ACCT 371 Directed Readings 1-3 Credits
Readings and research in various fields of accounting; designed for superior students who have a special interest in some topic or topics not covered by the regularly rostered courses. Written term paper(s) required. Must have preparation acceptable to the department chair.
Repeat Status: Course may be repeated.

ACCT 372 Special Topics 1-3 Credits
Special problems and issues in accounting for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of the instructor and students. Must have preparation in accounting acceptable to the department chair.

ACCT 410 Essential Tax Planning for Business Strategies 3 Credits
Designed for all College of Business graduate students, regardless of prior tax knowledge, seeking to enhance client value by understanding the tax implications of their transactions. The course covers federal and state tax policy, planning, and compliance, and explores the key tax aspects of entity selection, financing, structuring (including investment banking and private equity considerations), securities, real estate holdings, and personal wealth management. Ideal for finance majors preparing for Series exams and accounting majors seeking CPA exam readiness.
Prerequisites: ACCT 151 or GBUS 401 or MBA 451

ACCT 432 Accounting for Managers 3 Credits
Study of key financial and managerial accounting concepts and their application in managing an organization. Students will apply analytical tools in the evaluation of the entity’s financial position, performance, and prospects. Key accounting concepts, the work of accounting regulators and how accounting policy choices impact the measurement of financial position and performance will be addressed. The curriculum will also include skills for managing a business, including budgeting, cost/volume/pricing analysis, performance evaluation, and differential analysis in decision making.
Prerequisites: GBUS 401 and MGT 431
Can be taken Concurrently: MGT 431

ACCT 442 Financial Reporting and Analysis 2 Credits
This course focuses on the organization, measurement, and interpretation of economic information in corporate financial reports. It emphasizes the use and interpretation of the financial statements issued by business organizations. Topics include: accounting concepts and principles, accrual accounting, accounting cycle, revenue, expense, asset, liability and equity accounts. Students are exposed to balance sheet valuation, income determination, cash flow analysis, accounting judgment, profit manipulation, evaluation of earnings quality, and the ethical framework to guide business decisions.

ACCT 444 Accounting for Decision Making 2 Credits
This course emphasizes the organization, measurement and interpretation of internal accounting information that managers use to make business decisions. Students learn techniques such as cost analysis, budgeting, performance evaluation, and employee motivation. Topics include: cost flows in service and manufacturing enterprises; product and process costing; transfer pricing; resource planning, evaluation and control through budgeting, make-or-buy decisions; activity-based costing; standard costing, and variance analyses; pricing and production decision making using cost-volume-profit analysis.
Prerequisites: ACCT 442

Business

The designation of “business” refers to general business courses.

Business Minor

Program Admission Requirements: Each spring, approximately 100 students will be accepted into the Business Minor Program for the following fall. Applications to the program will be made by students and submitted to the program director by the last Friday in January. An admissions committee comprised of the Business Minor Program director and the Business Minor curriculum committee will make admission decisions based on G.P.A., experience, and interest in pursuing business opportunities upon graduation from Lehigh (to be evaluated on the basis of a written essay). Students will be notified of admissions decisions prior to registration for the fall semester. Applications are restricted to students from the P.C. Rosin College of Engineering and Applied Science, the College of Arts and Sciences, and College of Health only.

Business Courses

BUS 001 Foundations of Business 0,1 Credits
This course orients students in the College of Business to the study of business and to the college's expectations of undergraduates. Different types of business organizations and their goals are introduced, including overviews of the functional areas of business, their contributions to organizations, and their related careers. Students will begin to identify their professional interests, understand the wider context of business, and be exposed to the College of Business programs and resources available to support their academic and professional success.

BUS 003 Business Communication I 1.5 Credit
Good business communication skills are essential for success on the job and career advancement. In this course, students are introduced to the frameworks and skills necessary to deliver communications that are professional, clear, concise, evidence-driven, and persuasive. Emphasis is on basic business communications including memos, reports, and presentations.
Prerequisites: BUS 001 or IBE 050 or BUHE 001
Can be taken Concurrently: BUS 001, IBE 050, BUHE 001

BUS 125 Behavioral Skills Workshop 1 Credit
BUS 125 is a aimed to equip students to work with others in a business setting in making business decisions. The focus of the class is on effective decision making and includes such topics as group and team decision making, conflict resolution and negotiation, ethical decision making, and creative problem solving. This course is offered as a series of intensive workshops in the fall semester and is heavily focused on experiential learning.
Prerequisites: ECO 001

BUS 126 Project Management Essentials 3 Credits
Introduction to the key fundamentals of project management theory and practice - a temporary endeavor undertaken to produce a unique product, service, or result. Focuses on a project from start to finish by managing the triple constraints of scope, budget, and schedule; also developing motivated teams, maximizing resources, streamlining processes, assuring quality, and formally closing out the project. Theory is reinforced through experiential learning, four part web-based simulation, and managing an actual project in teams.
Prerequisites: BUS 125
Can be taken Concurrently: BUS 125

BUS 127 Product Innovation and Marketing Strategies 3 Credits
Introduction to the key elements in a company's marketing framework. Focus on defining marketing, analyzing the market competitors, developing effective marketing strategies, segmenting the market, creating customer value, delight and loyalty, analyzing consumer and business markets, creating brand equity, and managing an effective marketing program to deliver the right products or services to the right audience at the right place, at the right price and the right time. Experiential learning through the development of a marketing plan.
Prerequisites: BUS 126

BUS 173 Non-Major Summer Internship 1-4 Credits
CBE internships expose students to the business world, enriching their understanding of ideas and problems encountered in their business courses. This course is available summers and open to students in the College of Business & Economics and those in the following programs: CSB, IBE, and Business Minor. Students are evaluated on a directed writing assignment and on a detailed evaluation provided by the work supervisor. A minimum of 150 hours of work must be completed in the internship, and verified by work supervisor. Course registration and related arrangements must be made in advance of the work experience. This course does not satisfy any major requirements. Must have completion of a minimum of 24 college credits.

BUS 178 Lehigh@NasdaqCenter Innovation Internship 3 Credits
Lehigh@NasdaqCenter Innovation Internship offers students an experiential learning opportunity exploring the entrepreneurial mindset. This high-impact course integrates a 10-15 hour per week remote, project-based internship with startups and innovation focused organizations, emphasizing the practical application of entrepreneurial skills. Through weekly class sessions blending theory and practice, facilitated by a Lehigh faculty member, students delve into topics pertaining to entrepreneurial leadership and innovation within Silicon Valley and other dynamic innovation ecosystems. Networking with industry leaders is paramount, enriching students' entrepreneurial connections.

BUS 203 Business Communication II 1.5 Credit
This course builds on the basic communication frameworks and skills from BUS 003 to enhance students’ business communications related to data, particularly oral communication. Students will translate data and analysis into narratives that provide context for their messages and make persuasive recommendations in written and oral formats.
Prerequisites: BUS 003 and (BUAN 244 or BIS 244 or CSB 311)
Can be taken Concurrently: BUAN 244, BIS 244, CSB 311

BUS 225 Understanding Business Accounting 3 Credits
An integrated introduction to business, accounting, and finance. Students are introduced to the goals, people, and activities of business before focusing on the fundamental elements of accounting and finance, including financial statement construction and analysis, time value of money, financing and investing with equity and debt, and the impact of various operating decisions on business. Experiential learning and development of team/communication skills are encouraged through portfolio simulation and financial analysis projects.
Prerequisites: BUS 127

BUS 226 Understanding Business Finance 3 Credits
This course builds upon the foundational teachings of BUS 225 through examination of topics in portfolio management, capital investment decision making, business planning, analysis and reporting, and various specialized topics such as entrepreneurship, business law, ethics, internal control systems, and E-business. Experiential learning and development of team/communication skills are encouraged through group projects and guest speakers.
Prerequisites: BUS 225

BUS 275 Essentials of Financial and Managerial Accounting 3 Credits
This combined accounting and finance course introduces the intricate realms of financial management and reporting. It offers a comprehensive understanding of financial analysis, budgeting, investment decisions, risk management, and financial statement interpretation. This course equips students with the skills to make sound financial decisions, evaluate investment opportunities, and effectively communicate financial information to stakeholders. It will assist in developing a student’s holistic understanding of business operations, ensuring they possess the necessary expertise to contribute to the success of any organization.
Prerequisites: BUS 127

BUS 276 Essentials of Supply Chain Management & Operations 3 Credits
Introduction to a comprehensive overview of the often overlooked but vital field of supply chain management and operations. Delve into the basics of how goods and services are produced and delivered, while making the connections between raw materials and finished products. Learn essential concepts such as procurement, production, distribution, and quality management. Work through practical examples to understand how these concepts influence daily life for both consumers and businesses.
Prerequisites: BUS 275

BUS 300 Apprentice Teaching 1-3 Credits

BUS 326 Business Strategy 1 Credit
Business Strategy is a capstone covering total enterprise problems in determination, execution, and control within a global setting. The course integrates the theories of production, marketing, finance and organization and provides an opportunity to study the function of higher level management as related to the total business environment through a team-based business simulation. Students will develop a business strategy and make decisions that impact performance metrics of the firm.
Prerequisites: BUS 226 or BUS 276
Can be taken Concurrently: BUS 226, BUS 276

BUS 347 Practicum in Real Estate I 2 Credits
This course is an interdisciplinary study of the creation of value in commercial real estate. Organized into groups, with each group assigned a different subject commercial real property, the class engages in the study of the physical and locational characteristics of commercial real estate as they relate to value including: property history; architecture; physical attributes that add to or detract from value; tenenat mix; the immediate neighborhood environment; and, the specific market in which the real property competes for tenants. Each group submits a written report of their findings and produces a 10-minute video documentary on their subject property. Permission of the instructor. Students enrolling in this course must also commit to enrolling in the follow-on course - Bus 348 - Practicum in Real Estate II.
Prerequisites: (ECO 145 or ECO 045 or ECO 146) and ACCT 151 and FIN 225

BUS 348 Practicum II in Real Estate 2 Credits
This course is a continuation if the interdisciplinary study of the creation of value in commercial real estate begun in Bus 347 - Practicum in Real Estate I. Organized into groups, with each group continuing with the subject commercial real property assigned to them in Bus 347, the class engages in the study of the market and financial characteristics of commercial real estate as they relate to value through: a financial analysis of the market in which their property is located to include market rents, market vacancy rates and market absorption rates; and, financial analysis of the subject property to include both historical results, and pro forma estimates of revenues, expenses, cash flow and residual value.
Prerequisites: BUS 347

BUS 478 Lehigh@NasdaqCenter Innovation Internship 3 Credits
Lehigh@NasdaqCenter Innovation Internship offers students an experiential learning opportunity exploring the entrepreneurial mindset. This high-impact course integrates a 10-15 hour per week remote, project-based internship with startups and innovation focused organizations, emphasizing the practical application of entrepreneurial skills. Through weekly class sessions blending theory and practice, facilitated by a Lehigh faculty member, students delve into topics pertaining to entrepreneurial leadership and innovation within Silicon Valley and other dynamic innovation ecosystems. Networking with industry leaders is paramount, enriching students' entrepreneurial connections.

BUS 490 Thesis (Moc) 1 Credit

BUS 492 (ARTS 492, ENGR 492) Summer Research 1-3 Credits
Summer research experience designated for business graduate students at both the master's and doctoral levels who are participating in full-time research during the entire summer semester. Students must have a summer research appointment to be eligible to enroll in this course. The course is repeatable; however, credits earned for this course cannot be used to fulfill any degree requirements.
Repeat Status: Course may be repeated.

BUS 499 Dissertation (Moc) 1 Credit

Courses
No courses found for IPRE

Business Analytics

The Business Analytics (BUAN) major, housed in the Department of Decision and Technology Analytics (DATA), prepares students with cutting-edge knowledge and skill sets that will enable them to be competitive in the rapidly growing field of business analytics, by focusing on using technological tools to extract, integrate, visualize, analyze, and interpret data to support business decision making. This program will provide students with a strong training in applied data and analytics skills which allow them to turn raw data into value for a business.

These skills can be applied in a broad range of functional areas and industries including management, marketing, operations, financial services, healthcare, and more. Career opportunities for BUAN majors include: business analyst, data analyst, research analyst, analytics consultants, risk analysts, and more.

The Business Analytics major requires 4 courses and 2 electives beyond the core requirements of the College of Business.

4 Required Courses		
BIS 324	Business Data Management	3
BUAN 348	Predictive Analytics in Business	3
BUAN 352	Business Analytics and Modelling	3
BUAN 357	Artificial Intelligence for Business	3
2 Elective Courses from the Following List:		
BIS 335	Application Development for Business	3
BUAN 346	Python Applications for Business	3
SCM 330	Analytics for Service Operations	3
SCM 345	Analytical Approaches to Supply Chain Management	3
ACCT 330	Accounting Data and Analytics	3
ECO 301	Econometric Software	3
ECO 357	Econometrics	3
ECO 367	Applied Microeconometrics	3
MKT/ECO 325	Consumer Insights through Data Analysis	3
MKT 326	Marketing Analytics and Artificial Intelligence in the Digital Space	3
FIN 377	Advanced Topics--Investments (Data Science for Finance)	3

Course descriptions for the College of Business graduate courses can be found under Business Graduate courses (p. 291).

Courses

BUAN 044 (BIS 044) Business Analytics I 1.5 Credit
This course covers the basic concepts of data, including the collection, organization, exploration, and understanding of data with an emphasis on complex business data. The focus is on data as an organizational asset, and how data is structured for use in business to optimize business decisions and processes. Students will implement data analytic techniques through hands on programming.

BUAN 244 (BIS 244) Business Analytics II 1.5 Credit
This course covers techniques and algorithms for creating effective visualizations of complex business data. The emphasis will be on the use of data visualization in business decision making. Students will implement data analysis and visualization through hands on programming and visualization tools.
Prerequisites: (BUAN 044 or BIS 044) and (ECO 045 or MATH 231 or ISE 121)

BUAN 346 Python Applications for Business 3 Credits
This class is designed to introduce students to the processes involved in acquiring, cleaning, arranging, analyzing, and visualizing business data using the Python programming language. It will be fast-paced, but assumes only a basic familiarity with coding, and requires no specific expertise in Python to start. Students cannot receive credit for both BUAN 346 and BIS 446.
Prerequisites: BIS 111

BUAN 348 Predictive Analytics in Business 3 Credits
The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics; and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data-visualization and data reduction techniques. Not available to students who have credit for BIS 448 or BIS 456.
Prerequisites: BIS 111 and (ECO 045 or MATH 012 or MATH 231)

BUAN 352 Business Analytics and Modelling 3 Credits
This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BUAN 352 and BIS 452.
Prerequisites: BIS 111 and (ECO 045 or MATH 012 or MATH 231)

BUAN 357 Artificial Intelligence for Business 3 Credits
This course covers fundamental concepts of artificial intelligence (AI) and how it is applied to solve business problems, to increase business value, transform businesses and to gain competitive advantage. A brief technical overview will be covered. Common machine learning (ML) algorithms will be covered and students will have hands-on experience with AI tools/frameworks. Example use cases of these ML algorithms in various business functional areas will be examined. Finally, ethical challenges in the AI context will be explored.
Prerequisites: BIS 111 and (ECO 045 or MATH 012 or MATH 231) and (BIS 044 or BUAN 044 or BIS 335 or CSE 002 or CSE 012 or CSE 007 or CSE 003)

BUAN 371 DIRECTED READINGS 1-3 Credits
Readings and research business analytics; designed for superior students who have special interest in some topic(s) not covered by the regularly scheduled courses. Written term paper(s) required. Must have preparation in business analytics acceptable to program coordinator.
Repeat Status: Course may be repeated.

BUAN 372 Special Topics in Business Analytics 1-3 Credits
Special problems and issues in business analytics for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of the instructor and students. Must have preparation in business analytics acceptable to program coordinator.
Repeat Status: Course may be repeated.

BUAN 373 Business Analytics Internship 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments-including a "capstone report." It should be noted that the work experience (at least 80 hours per credit), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements, including designating a sponsoring faculty member, must be made in advance of the work engagement. This course must be taken Pass/Fail.
Repeat Status: Course may be repeated.

BUAN 446 Python Applications for Business 3 Credits
This class is designed to introduce students to the processes involved in acquiring, cleaning, arranging, analyzing, and visualizing business data using the Python programming language. It will be fast-paced, but assumes only a basic familiarity with coding, and requires no specific expertise in Python to start. Students cannot receive credit for both BUAN 346 and BUAN 446.

BUAN 448 Predictive Analytics in Business 3 Credits
The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics; and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data-visualization and data reduction techniques. Not available to students who have credit for BUAN 348 or BIS 456.

BUAN 452 Business Analytics and Modelling 3 Credits
This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BUAN 352 and BUAN 452.
Prerequisites: ECO 045 or BUEC

BUAN 457 Artificial Intelligence for Business 3 Credits
This course covers fundamental concepts of artificial intelligence (AI) and how it is applied to solve business problems, to increase business value, transform businesses and to gain competitive advantage. A brief technical overview will be covered. Common machine learning (ML) algorithms will be covered and students will have hands-on experience with AI tools/frameworks. Example use cases of these ML algorithms in various business functional areas will be examined. Finally, ethical challenges in the AI context will be explored.
Prerequisites: BUAN 446

Business and Economics Graduate Programs and Courses

The College of Business (https://business.lehigh.edu/graduate/) is accredited by AASCB International; the Association to Advance Collegiate Schools of Business.

Graduate degree programs offered by the college include:

- Master of Business Administration
- Master of Science in Applied Economics
- Master of Science in Business Analytics
- Master of Science in Management
- Ph.D. in Business and Economics

Interdisciplinary degree programs (p. 507) are offered through partnerships with other colleges:

- P.C. Rossin College of Engineering and Applied Science - Master of Business Administration and Engineering
- P.C. Rossin College of Engineering and Applied Science and the College of Arts and Sciences - Master of Science in Financial Engineering

- College of Education - Master of Business Administration and Educational Leadership
- College of Health - Master of Business Administration and Master of Public Health (dual-degree)

Courses for the programs are taught by faculty from the Accounting (p.), Data and Technology Analytics (DATA, Business Information Systems (https://catalog.lehigh.edu/coursesprogramsandcurricula/businessandeconomics/businessinformationsystems/) and Supply Chain Management (https://catalog.lehigh.edu/coursesprogramsandcurricula/businessandeconomics/supplychainmanagement/)), Economics (p.), Finance (p.), Management (p.), and Marketing (p.) departments.

GRADUATE DEGREES IN BUSINESS ADMINISTRATION AND ECONOMICS

Candidates for admission to graduate study in the College of Business may be required to provide the results obtained in the Graduate Management Admissions Test (GMAT) or the Graduate Record Examination general test (GRE).

International applicants are required to submit evidence of English proficiency through one of the following methods: a) prior study in a country where the primary language is English, b) by taking the Test of English as a Foreign Language (TOEFL) examination, c) by taking The International English Language Testing System (IELTS) examination, or d) by taking the Duolingo English Assessment for admission to the program. Please consult with your program of choice to determine which requirements are appropriate for submission.

MASTER OF BUSINESS ADMINISTRATION

Lehigh MBA programs provide rich learning experiences for students. The College of Business offers three MBA programs: one-year, full-time MBA program (1-MBA); online, part-time MBA program (FLEX); Executive MBA program.

ONE YEAR, FULL-TIME MBA PROGRAM

1-MBA Mission Statement:

The One Year, Full-Time MBA Program develops and positions students for organizational and career success as strategic thinkers in an environment that seeks solutions beneficial to business and society. In a 12-month program format, it provides not only a rigorous and comprehensive coverage of fundamental business principles but also helps students use an integrated framework for addressing large, multi-stakeholder organizational challenges. Students in the 1-MBA program will apply their learning in a year-long consulting practicum experience, where students will learn about the consulting mindset and translate this, along with their other MBA coursework, into C-level consulting engagements with real companies. 1-MBA students also have opportunities for extensive networking with peers, alumni, experienced executives, faculty, and coaching professionals.

The One Year Full-Time MBA Program (henceforth 1-MBA) is designed for individuals who already have at least two years of work experience and wish to either pivot their careers into a business-related area that may not be in their previous field of employment or accelerate their career within their chosen field. This MBA program is designed to accommodate those from non-business-related fields, as well as students whose undergraduate major is in business but who may want to change their focus, such as from finance to marketing.

The 1-MBA program, which starts each summer, is a cohort-based, lockstep program initially to develop core knowledge of functional areas and team building. These courses emphasize a stakeholder perspectives approach. A consulting practicum provides students with substantive and practical hands-on experience. The final part of the program emphasizes building domain expertise via electives or concentrations, with a focus on data analytics and leadership. Another feature is a dedicated coaching team consisting of a professional staff member, an alumnus, and a faculty member.

The program offers concentrations in Business Analytics, Financial Management, Marketing, and Supply Chain Management. Students may also opt to complete electives of their choice and earn the Business Administration (general) major.

Program Requirements

The following are pre-requisites for students prior to arrival on campus to begin the program:

1. Calculus knowledge as evidenced by an acceptable grade in a college-level calculus class
2. English proficiency (for international students) as evidenced by a high TOEFL or IELTS score and via interviews with the admissions committee
3. Economics knowledge as evidenced by an acceptable grade in a college-level elementary economics course
4. Acceptable grades in Approved Online Tests as determined by program faculty, such as
(a) Quantitative Methods, (b) Statistics, (c) Excel

ONE-YEAR FULL-TIME MBA PROGRAM, GENERAL (MAJOR: BUSINESS ADMINISTRATION)

Summer Semester		**9**
PMGT 409	Project Management Fundamentals	3
MBA 440	Quantitative Methods	3
MBA 441	Professional Development	1
MBA 442	Societal Shifts I	2
Orientation (Non-credit requirement)		
Fall Semester		**18**
Module I (7 weeks)		
Functional Area Core Knowledge		
MBA 451	Accounting 1-MBA	1.5
MBA 452	Economics and Markets 1-MBA	1.5
MBA 453	Finance 1-MBA	1.5
MBA 454	Management - OB/HR 1-MBA	1.5
MBA 455	Marketing 1-MBA	1.5
Module II (7 weeks)		
Stakeholders Perspective		
MBA 456	Strategy 1-MBA	1.5
MBA 461	Financial Claimants 1-MBA	1.5
MBA 462	Government & Society 1-MBA	1.5
MBA 463	Suppliers and Customers 1-MBA	1.5
MBA 464	Employees 1-MBA	1.5
Module III (14 weeks)		
MBA 441	Professional Development	1
MBA 457	Consulting Practicum I	2
Winter Intersession		
MBA 443	Societal Shifts II	4
Spring Semester		**16**
MBA 465	Consulting Practicum II	4
BIS 456	Business Analytics for Decision Making	3
Graduate Elective I		3
Graduate Elective II		3
Graduate Elective III		3
Summary of credit hours		
Summer Session		9
Fall Semester		18
Winter Intersession		4
Spring Semester		16
TOTAL		**47**

ONE-YEAR FULL-TIME MBA PROGRAM, BUSINESS ANALYTICS (MAJOR: BUSINESS ANALYTICS), supply chain management (Major: supply chain management)

Summer Semester		**9**
PMGT 409	Project Management Fundamentals	3
MBA 440	Quantitative Methods	3
MBA 441	Professional Development	1

MBA 442	Societal Shifts I	2
Orientation (non-credit requirement)		
Fall Semester		**18**
Module I (7 weeks)		
Functional Area Core Knowledge		
MBA 451	Accounting 1-MBA	1.5
MBA 452	Economics and Markets 1-MBA	1.5
MBA 453	Finance 1-MBA	1.5
MBA 454	Management - OB/HR 1-MBA	1.5
MBA 455	Marketing 1-MBA	1.5
Module II (7 weeks)		
Stakeholders Perspective		
MBA 456	Strategy 1-MBA	1.5
MBA 461	Financial Claimants 1-MBA	1.5
MBA 462	Government & Society 1-MBA	1.5
MBA 463	Suppliers and Customers 1-MBA	1.5
MBA 464	Employees 1-MBA	1.5
Module III (14 weeks)		
MBA 441	Professional Development	1
MBA 457	Consulting Practicum I	2
Winter Intersession		
MBA 443	Societal Shifts II	4
Spring Semester-Business Analytics		**16**
MBA 465	Consulting Practicum II	4
BIS 456	Business Analytics for Decision Making	3
Approved Graduate Business Analytics I Elective		3
Approved Graduate Business Analytics II Elective		3
Approved Graduate Business Analytics III Elective		3
Summer Session - Business Analytics		**6**
BIS 458	Data Management for Managers	3
Approved Graduate Business Analytics IV Elective		3
Spring Semester - Supply Chain Management		**16**
MBA 465	Consulting Practicum II	4
BIS 456	Business Analytics for Decision Making	3
GBUS 453	Transportation and Logistics Management	3
SCM 309	Supply, Cost, and Risk Managment	3
SCM 330	Analytics for Service Operations	3
OR		
SCM 342	e-Business Enterprise Applications	3
Summer Session - Supply Chain Management		**6**
BIS 458	Data Management for Managers	3
GBUS 432	Demand and Supply Chain Planning	3
Approved Graduate Level SCM course(s) as determined by the DATA department		
Summary of Credit Hours		
Summer Session (entry)		9
Fall Semester		18
Winter Intersession		4
Spring Semester		16
Summer Session (last semester)		6
TOTAL		**53**

ONE-YEAR FULL-TIME MBA PROGRAM, FINANCIAL MANAGEMENT (MAJOR FINANCIAL MANAGEMENT), OR MARKETING (MAJOR MARKETING)

Summer Semester		**9**
PMGT 409	Project Management Fundamentals	3
MBA 440	Quantitative Methods	3
MBA 441	Professional Development	1
MBA 442	Societal Shifts I	2
Orientation (Non-credit requirement)		
Fall Semester		**18**
Module I (7 weeks)		
Functional Area Core Knowledge		
MBA 451	Accounting 1-MBA	1.5
MBA 452	Economics and Markets 1-MBA	1.5
MBA 453	Finance 1-MBA	1.5
MBA 454	Management - OB/HR 1-MBA	1.5
MBA 455	Marketing 1-MBA	1.5
Module II (7 weeks)		
Stakeholders Perspective		
MBA 456	Strategy 1-MBA	1.5
MBA 461	Financial Claimants 1-MBA	1.5
MBA 462	Government & Society 1-MBA	1.5
MBA 463	Suppliers and Customers 1-MBA	1.5
MBA 464	Employees 1-MBA	1.5
Module III (14 weeks)		
MBA 441	Professional Development	1
MBA 457	Consulting Practicum I	2
Winter Intersession		4
MBA 443	Societal Shifts II	4
Spring Semester		16
MBA 465	Consulting Practicum II	4
BIS 456	Business Analytics for Decision Making	3
Approved Concentration Course I		3
Approved Concentration Course II		3
Approved Concentration Course III		3
Summer Semester		3
Approved Concentration Course IV		3
Marketing Major		**12**
A minimum of two approved marketing elective courses must be at the 400 level		
Approved Marketing Elective I (from current or future offering)		3
Approved Marketing Elective II (from current or future offering)		3
Approved Marketing Elective III (from current or future offering)		3
Approved Marketing Elective IV (from current or future offering)		3
Financial Management		**12**
GBUS 419	Financial Management (spring)	3
GBUS 420	Investments (spring)	3
Select 3 of the following 4 courses:		
GBEN 407	Startups & Pivots (spring)	
GBEN 409	Financial Forecasting (spring)	
GBEN 410	Financing Startups (spring)	
GBEN 412	Going Public (spring)	
GBUS 424	Advanced Topics in Financial Management (summer)	3
Summary of Credit Hours		
For Majors in Financial Management, Marketing, and Supply Chain Management		
Summer Session (entry)		9
Fall Semester		18
Winter Intersession		4
Spring Semester		16

Summer Session (last semester)	3
TOTAL	**50**

Program Admission Requirements

Admission to the 1-MBA program (https://business.lehigh.edu/academics/graduate/masters-programs/one-year-mba/admissions-information/) will be based on the applicants essay, resume or CV, transcripts, 2 letters of recommendation, interview, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. Two years of professional work experience is required. International students must show English proficiency. (https://business.lehigh.edu/graduate/english-language-proficiency/)

Dual Degree Option: MBA and Public Health

The One Year, Full-Time MBA program offers a dual degree program (https://business.lehigh.edu/academics/graduate/masters-programs/one-year-mba/mph-dual-degree/) with the Masters of Public Health through the College of Health. Students are able to earn the two degrees in a two years.

Questions? Contact us (p. 299) or visit our website: https://business.lehigh.edu/1-mba (https://business.lehigh.edu/one-year-mba/)

FLEX MBA PROGRAM

Lehigh's FLEX MBA curriculum is a fully integrated model that simulates the business environment in the classroom. Business issues are viewed and taught from the perspective of the firm as a whole rather than along departmental lines. FLEX MBA students acquire leadership, managerial communication, and resource allocation skills coupled with a comprehensive understanding of complex domestic and global business issues.

Due to the compact and integrated core, students have increased flexibility to tailor the program to their individual needs. Students may select a concentration in business analytics, corporate entrepreneurship, finance, international business, marketing, project management, public health, or supply chain management, or pursue a broader experience by selecting courses from a variety of disciplines. Students may only have one concentration.

The FLEX MBA program is available both on-campus and online. Students may opt to attend class through both methods of delivery. All FLEX MBA concentrations are available through online study.

FLEX MBA Mission Statement:

The FLEX MBA program will further the development of organizational leaders and managers. This is accomplished by honing students' knowledge, skills, and abilities through a comprehensive and integrated core curriculum and customized concentrations designed to meet individual needs. The FLEX MBA program will also foster life-long learning through continuing professional education programs.

Core Courses		
MGT 431	Leadership in Contemporary Organizations	1.5
ACCT 432	Accounting for Managers	3
FIN 433	Financial Analysis for Managers	3
BIS 434	Decision Analytics for Managers	3
SCM 435	Operations and Supply Chain Management	3
MGT 436	Managing People	3
MKT 437	Customer Insights and Marketing Strategy for Managers	3
MGT 438	Strategy for Competitive Advantage	3
MGT 439	Applied Capstone Experience (ACE)	1.5
Electives		
Select 12 credit hours of elective coursework. Students may design an area of study in consultation with their advisor or select an area of concentration. Concentrations require the completion of 12 credit hours. Students may undertake, with proper approvals, a maximum of six credit hours of electives outside of the College of Business, but within Lehigh University. The exception to this 6-credit rule is for students who undertake the concentration in Public Health. The Public Health concentration requires the completion of 12 credit hours in courses within the College of Health. All elective courses must be at the 400 level.		12
Total Credits		**36**
Business Analytics Concentration		
Credits Required		12
Directed Electives (6 credits)		
BIS 458	Data Management for Managers	3
AND		
BUAN 448	Predictive Analytics in Business	3
OR		
BIS 456	Business Analytics for Decision Making	3
Choose 6 credits:		
BUAN 452	Business Analytics and Modelling	3
ECO 403	Econometric Software	3
GBUS 424	Advanced Topics in Financial Management	3
GBUS 466	Marketing Research and Analysis	3
MACC 430	Data Analytics for Accountants	3
Corporate Entrepreneurship Concentration		
Credits Required		12
Select 12 credits from any of the following courses:		
GBEN 401	Business Plan I	2
GBEN 402	Business Plan II	2
GBEN 403	Anatomy of Entrepreneurship	1
GBEN 404	Market Opportunity	1
GBEN 405	Intellectual Property	1
GBEN 406	Performing Due Diligence	1
GBEN 407	Startups & Pivots	1
GBEN 409	Financial Forecasting	1
GBEN 410	Financing Startups	1
GBEN 412	Going Public	1
GBEN 413	Integrative Experience/New Venture Internship	1-4
GBEN 414	Ventures in Brand Licensing	1
GBEN 415	LehighSiliconValley	1-3
GBEN 492	Special Topics	1-3
Finance Concentration		
Credits Required		12
Directed Electives (6 credits)		
GBUS 419	Financial Management	3
GBUS 420	Investments	3
Choose 2 of 3 courses (6 credits)		
GBUS 424	Advanced Topics in Financial Management	3
GBUS 426	Financial Markets and Institutions	3
GBUS 473	International Finance	3
International Business Concentration		
Credits Required		9
Select 9 credits from the following courses:		
GBUS 473	International Finance	3
GBUS 475	Global Marketing Strategies	3

GBUS 492	Special Topics (Repeatable, includes immersion trips)	1-4

Marketing Concentration

Credits Required		12
Select 12 credits from the following:		
GBUS 460	Strategic Marketing Management	3
GBUS 465	Creating Breakthrough Innovations	3
GBUS 466	Marketing Research and Analysis	3
GBUS 467	Sales Management	3
GBUS 468	Future of Marketing	3
GBUS 470	Marketing Communications Strategies	3
GBUS 471	Strategic Brand Management	3
GBUS 475	Global Marketing Strategies	3

Project Management Concentration

Credits Required		12
Directed Electives (7 credits)		
PMGT 409	Project Management Fundamentals	
PMGT 410	Project Requirements and Scope Management	
PMGT 411	Project Scheduling, Estimating & Budgeting	
PMGT 413	Project Risk Management	
PMGT 416	Decision Making and Ethics on Projects	1
Choose 5 credits:		
PMGT 412	Advanced Scheduling & Scheduling Tools	
PMGT 414	Managing Project Quality	
PMGT 415	Project Procurement & Negotiation	
PMGT 417	Project Leadership	1
PMGT 418	Facilitation and Teamwork for Projects	1
PMGT 419	Adaptive and Agile Project Management	1
PMGT 420	Managing Projects for Innovation	1
PMGT 421	Project Management Capstone	

Public Health Concentration

Credits Required:		12
Required Courses		
BSTA 402	Biostatistics in Health	3
PUBH 402	Health Services, Administration, Politics, and Policy	3
POPH 405	Qualitative Research Methods	3
Select One:		
EPI 404	Methods in Epidemiology I	3
PUBH 401	Health Promotion and Education	3
PUBH 403	Health Program Planning and Implementation	3
POPH 409	Social Determinants of Health	3
POPH 431	Environmental Health Justice	3

Supply Chain Management Concentration

Credits Required:		12
Directed Electives (9 credits)		
GBUS 432	Demand and Supply Chain Planning	3
GBUS 450	Strategic Supply Management	3
GBUS 453	Transportation and Logistics Management	3
Select 3 credits		
GBUS 447	Negotiation	3
GBUS 456	Applied Supply Chain Models	3
BIS 456	Business Analytics for Decision Making	3
GBUS 492	Special Topics	1-4

Prerequisites

Students should have completed undergraduate courses in computer literacy, and principles of microeconomics and macroeconomics. The prerequisites of financial accounting and statistics may be completed after acceptance into the Flex MBA program

The statistics prerequisite may be fulfilled by having taken a class within the past 5 years and receiving a “B” or better, by taking a proficiency exam administered through the College, or by enrolling in Basic Statistics for Business and Industry or equivalent. The Accounting prerequisite may be waived by enrolling in Financial Accounting for Managers and Investors at Lehigh or by taking a proficiency exam administered by the College.

If a student has no previous background in financial accounting or statistics, he/she is encouraged to take a course in the subject area. If a student has previously taken coursework but has not achieved a grade of “B” or the course has exceeded the time limit, self-directed learning and a proficiency exam may be appropriate.

The prerequisites of financial accounting and statistics must be completed before enrolling in ACCT 432 Accounting for Managers, BIS 434 Business Analytics for Managers and/or SCM 435 Operations and Supply Chain Management.

Waiver Policy

There are no waivers for courses in the Flex MBA Program.

GMAT or GRE Scores

The submission of test scores through the Graduate Management Admissions Test (GMAT) administered by Pearson Vue or the Graduate Record Exam (GRE) administered by the Educational Testing Service (ETS) is optional.

Work Experience

Students are required to have a minimum of 2 years of full-time, professional work experience.

International Students/English Language assessment

International students must have 16 years of formal education, including four years at the university level, to be considered for admission to Lehigh’s graduate programs. Applicants whose native language is not English are required to take one of the following English Assessments: TOEFL, IELTS, or DuoLingo.

Flexible Class Scheduling

Classes are scheduled Monday through Thursday evenings, with seminars offered on Fridays and Saturdays and full-week immersions available. Part-time students may complete the entire program with evening classes. Many students accelerate the completion of the program by taking courses during the two six-week summer sessions.

Questions? Contact us (p. 299) or visit our website: business.lehigh.edu/flex-mba (https://business.lehigh.edu/flex-mba/)

MASTER OF BUSINESS ADMINISTRATION AND EDUCATIONAL LEADERSHIP

The MBA & Educational Leadership joint degree program offers students the opportunity to acquire a solid foundation in both business and education. Designed to develop the administrative skills required in today’s educational systems, the MBA and Educational Leadership program provides a framework where excellent education and sound business practices can flourish. The MBA/Ed. Leadership will provide an additional option for business students in educational leadership. The program will enhance the student's marketability in private and public sector education while providing students with an understanding of the cultures of both business and education. Core courses from both colleges will ensure that recipients of the joint degree will bring to their future positions an extraordinary medley of skills to manage human and financial resources efficiently while employing expertise in instructional supervision and training in both education and corporate settings. This program of study will enhance training and skills for those currently in the area of business and

financial management in the field of education. The Lehigh MBA and Educational Leadership degree is a joint, 45-credit-hour program.

ADMISSION REQUIREMENTS

Applications need to be approved through both the MBA program and the Educational Leadership program. Students must have at least 2 years of professional post-graduate work experience to apply for this joint degree program.

Further information about the program may be obtained by contacting Dr. Floyd D. Beachum, Associate Professor, College of Education, at 610-758-5955 / fdb209@lehigh.edu, or the Graduate Programs Office of the College of Business at (610) 758-4450 / business@lehigh.edu.

Visit our website: business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-educational-leadership (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-educational-leadership/)

MASTER OF BUSINESS ADMINISTRATION AND ENGINEERING

The University is committed to developing leaders in business and in industry: the MBA & Engineering degree unites two premier programs in one powerful joint degree by offering a solid foundation in both business and engineering.

Graduates of the MBA & Engineering program will be prepared to assume leadership positions in industrial planning, venture capital, and engineering management; and as senior managers in roles requiring both technical and business acumen.

The 45 credit hour program is taught in an interactive manner by faculty who are leaders in their fields with a wealth of practical experience; it also combines core business courses and a core of engineering courses:

The basic 45 credit hour course sequence consists of:

MBA core courses	18
Engineering core courses	12
Business electives	5
Engineering electives	6
Free electives	3
Integrated project	1
Total Credits	**45**

Students can choose an appropriate engineering curriculum from any of the following programs – chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, environmental engineering, industrial and systems engineering, manufacturing systems engineering, materials science and engineering, mechanical engineering, or polymer science and engineering.

MBA Core Courses

MBA 401	Introduction to the Organization and its Environment	2
MBA 402	Managing Financial and Physical Resources	4
MBA 403	Managing Information	4
MBA 404	Managing Products and Services	4
MBA 405	Managing People	4

ENGINEERING CORE COURSES

Each engineering program has its own set of core courses. Course choices are intended to be as flexible as possible, and are tailored to meet the needs of individual students. Further information can be obtained from the appropriate departmental graduate coordinator, or from the Office of Graduate Studies (610-758-6310) in the P.C. Rossin College of Engineering and Applied Science.

Electives

Engineering electives are chosen from courses in the appropriate P.C. Rossin College of Engineering and Applied Science (RCEAS) engineering program and the business electives are selected from course offerings in COB. Electives can also be chosen from joint courses that are being developed by RCEAS & COB.

Project

All students are required to do a short interdisciplinary project. Project topics, based on the specific interests of each student, will be developed by RCEAS faculty.

Admissions

Applications must be accepted by the MBA program and the relevant department in the P.C. Rossin College of Engineering and Applied Science. Consult with admissions to determine if GRE or GMAT scores are necessary for admission.

Further information can be obtained from:

Office of Graduate Studies
P.C. Rossin College of Engineering & Applied Science
610-758-6310

or

The Graduate Programs Office
College of Business
610-758-4450

Visit our website: business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-engineering (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/mba-engineering/)

EXECUTIVE MBA PROGRAM (EMBA)

The Lehigh Executive MBA Program (EMBA) program is designed to cultivate already seasoned business leaders with greater strategic vision, more global and societal perspectives, enhanced innovativeness, and a sincere commitment to the greater good in the Data Age. EMBA Students will develop a better understanding of their strengths and passions and will challenge them to consistently think critically about ways to transition organizations for success in today's dynamic, ever-changing global environment. While students will learn the fundamentals in all business disciplines and their integrations with data-driven decision making, they will also learn how to diagnose and solve complex business problems in dynamic global and societal settings in their quest for driving sustainable value creation.

MODULE 1: Business Essentials in Data Age		
18 credits required in the following courses:		
MBA 471	Accounting for Executives	3
MBA 472	Essentials of Economics for Executives	3
MBA 473	Financial Management for Executives	3
MBA 474	Marketing Essentials for Executives	3
MBA 475	Operations and Supply Chain Management for Executives	3
MBA 476	Talent Management for Executives	3
MODULE 2: Strategic Management and Leadership		
9 credits required in the following courses:		
MBA 481	Mastering Strategy	3
MBA 482	Executive Leadership	3
MBA 483	Digital Strategies for Organization Transformation	3
MODULE 3: Global and Societal Perspectives		
6 credits required in the following courses:		
MBA 484	Societal Challenges: Implications for Business	3
Plus 1 course from this list:		
GBUS 473	International Finance	3
GBUS 475	Global Marketing Strategies	3
Special Topics or Experimental Courses as approved by program administration		3
MODULE 4: Elective Module		
Choose 9 credits from Graduate Business Electives		9
MODULE 5: Experiential Learning Module		
6 credits required in the following courses:		
GBUS 493	Experiential Learning Study Trip	3

GBUS 494	Field Projects	3
Total Credits		48

Program Format

The program is designed for 16 months in time to completion. Courses are delivered in person one weekend per month, complemented with online preparation and summary discussion before and during weekend meetings.

Admission Requirements

- A bachelor's degree from an accredited university
- A minimum of six years of full-time work experience
- Demonstrated potential for success at senior management levels
- Demonstrated ability and motivation to complete a rigorous and intensive course of study while employed
- For international students, demonstrated proficiency in English through standard tests such as TOEFL, IELTS, or Duolingo is required.
- Three recommendation letters
- Candidate essays
- Interview required

Questions? Contact us (p. 299) or visit our website: business.lehigh.edu/academics/graduate/masters-programs/executive-mba (https://business.lehigh.edu/academics/graduate/masters-programs/executive-mba/)

MASTER OF SCIENCE IN APPLIED ECONOMICS

The program requires 30 credit hours, typically completed in 16 months starting in the fall of one academic year and finishing in the fall of the subsequent year. Some students may complete the program in 12 months by taking extra courses in the fall and spring semesters and in the summer session.

Core Required Courses		**15**
ECO 402	Managerial Economics	3
ECO 403	Econometric Software	3
ECO 412	Mathematical Economics	3
ECO 415	Econometrics I	3
ECO 417	Advanced Macroeconomic Analysis	3
Program Tracks - choose one of the two tracks below		**9**
A. Competition and Market Analysis		
ECO 404	Applied Microeconometrics	3
ECO 447	Economic Analysis of Market Competition	3
Plus one of the following:		
BIS 448	Course BIS 448 Not Found	3
ECO 431	Quantitative Market Analysis	3
ECO 456	Industrial Organization	3
ECO 463	Topics in Game Theory	3
ECO 325	Consumer Insights through Data Analysis	3
ECO 336	Antitrust, Regulation, and the New Economy	3
B. Policy Economics		
ECO 404 Applied Microeconometrics		3
Plus two of the following:		
ECO 425	Cost-Benefit Analysis	3
ECO 428	Electricity Economics	3
ECO 440	Labor Economics I	3
ECO 441	Labor Economics II	3
ECO 460	Time Series Analysis	3
ECO 303	Economic Development	3
ECO 311	Environmental Economics	3
ECO 322	Competitor and Market Analysis	3
ECO 328	Electricity Economics	3
ECO 339	International Trade	3
ECO 340	International Finance	3
ECO 345	Political Economy of Iraq	3
ECO 353	Public Economics	3
ECO 365	Business, Government, and Macroeconomic Policy	3
ECO 368	Health Economics	3
ECO 336 Antitrust, Regulation, and the New Economy		3
Elective Courses		**6**

Substitutions may be permitted for courses that count toward the program tracks, with the approval of the M.S. program advisor. Students may choose to write a master's thesis as part of their elective credits. The thesis is worth up to six credit hours and is most relevant for those who may be considering a Ph.D. in economics.

The M.S. in Applied Economics Director must approve all elective coursework outside of economics.

PROGRAM ADMISSION REQUIREMENTS

Admission to the MSAE program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-applied-economics/admissions-information/) will be based on the applicants essay, resume or CV, transcripts, 2 letters of recommendation, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. International students must show English proficiency. (https://business.lehigh.edu/graduate/english-language-proficiency/)

Lehigh undergraduate students may opt for a 4+1 program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-applied-economics/accelerated-program/) that would allow the M.S. in Applied Economics degree to be completed in an accelerated mode.

Further information about the MS in Applied Economics program may be obtained by contacting Alex Nikolsko-Rzhevskyy, Program Director M.S. in Applied Economics, at (610) 758-0240 / aln812b@lehigh.edu.

Questions? Contact us (p. 299) or visit our website: business.lehigh.edu/msae (https://business.lehigh.edu/ms-applied-economics/)

MASTER OF SCIENCE IN BUSINESS ANALYTICS

The Master of Science in Business Analytics (MSBA) program is designed to prepare students with cutting-edge knowledge and skillsets that will enable them to be competitive in the rapidly growing field of business analytics. This program starts in the summer term and is designed to be completed in one year. Students may opt to pursue a concentration in Financial Engineering Analytics, Marketing Analytics, Data Science, or Supply Chain Analytics.

The curriculum features three components that ensure students understand theory in-depth and develop practical skillsets:

- Disciplinary knowledge. Students learn the fundamentals of business and economics so that they understand business data and problems.
- Technical skills. Students learn software skills, such as SQL, R, Python, and Tableau, on collecting, preparing, modeling, and interpreting business data.
- Professional skills. Students develop soft skills in leadership, communication, teamwork, etc. They also develop their networks and are prepared for the job market.

Prerequisites (At Least 9 Credits)		
Calculus I (MATH 021 or MATH 081 or equivalent)		
Principles of Economics (ECO 001 or equivalent)		
Statistics (ECO 045 or equivalent)		
Summer Courses		**6**
Orientation Required		
BUAN 446	Python Applications for Business	3
DSCI 310	Introduction to Data Science	3
OR		
BIS 497	(Introduction to Data Science)	3

Fall Courses		**13.5**
BIS 411	Storytelling in Business Analytics	1.5
BUAN 448	Predictive Analytics in Business	3
BUAN 457	Artificial Intelligence for Business	3
BIS 458	Data Management for Managers	3
GBUS 405	Career and Professional Development I	1
Elective I		3
Spring Courses		**13.5**
BIS 412	Data Ethics and Security in Business	1.5
BIS 415	Capstone Project	3
BUAN 452	Business Analytics and Modelling	3
Elective II		3
Elective III		3

Elective List

DSCI 321	Algorithms and Software Foundations for Data Science	3
DSCI 411	Data Management for Big Data	3
DSCI 421	Accelerated Computing for Machine Learning	3
DSCI 431	Introduction to Statistical Modeling	3
DSCI 441	Statistical and Machine Learning	3
ECO 404	Applied Microeconometrics	3
ECO 415	Econometrics I	3
FIN 377	Advanced Topics--Investments (Financial Data Science)	3
GBUS 421	Advanced Investments	3
GBUS 422	Derivatives and Risk Management	3
GBUS 432	Demand and Supply Chain Planning	3
GBUS 449	Talent Analytics	3
GBUS 453	Transportation and Logistics Management	3
GBUS 461	Marketing Analytics	3
GBUS 466	Marketing Research and Analysis	3
ISE 426	Optimization Models and Applications	3
ISE 447	Financial Optimization	3
MACC 419	Auditing	3
MACC 430	Data Analytics for Accountants	3
MATH 312	Statistical Computing and Applications	3,4
MKT 312	Marketing Research	3
MKT 325	Consumer Insights through Data Analysis	3
MKT 326	Marketing Analytics and Artificial Intelligence in the Digital Space	3
PMGT 409	Project Management Fundamentals	3
SCM 330	Analytics for Service Operations	3
SCM 345	Analytical Approaches to Supply Chain Management	3
STAT 410	Random Processes and Applications	3

Data Science Concentration (9 credits, choose 3 courses)

DSCI 321	Algorithms and Software Foundations for Data Science	3
DSCI 411	Data Management for Big Data	3
DSCI 421	Accelerated Computing for Machine Learning	3
DSCI 431	Introduction to Statistical Modeling	3
DSCI 441	Statistical and Machine Learning	3

Marketing Analytics Concentration (9 credits, Choose 3 courses)

GBUS 461	Marketing Analytics	3
GBUS 466	Marketing Research and Analysis	3
MKT 312	Marketing Research	3
MKT 325	Consumer Insights through Data Analysis	3
MKT 326	Marketing Analytics and Artificial Intelligence in the Digital Space	3

Supply Chain Analytics Concentration (9 credits, Choose 3 courses)

GBUS 432	Demand and Supply Chain Planning	3
GBUS 453	Transportation and Logistics Management	3
SCM 330	Analytics for Service Operations	3
SCM 345	Analytical Approaches to Supply Chain Management	3

Financial Engineering Analytics Concentration (9 credits)

Choose One:		3
GBUS 421	Advanced Investments	
GBUS 422	Derivatives and Risk Management	
Choose One:		3
MATH 312	Statistical Computing and Applications	
STAT 410	Random Processes and Applications	
Choose One:		3
ISE 426	Optimization Models and Applications	
ISE 447	Financial Optimization	

Degree Requirements		**33**
Prerequisite Courses (at least 9 credits, do not count towards the degree)		
MATH 021	Calculus I (or equivalent)	4
ECO 001	Principles of Economics (or equivalent)	4
ECO 045	Statistical Methods (or equivalent)	3
ORIENTATION REQUIRED		
REQUIRED COURSES:		**26**
BIS 411	Storytelling in Business Analytics	
BIS 412	Data Ethics and Security in Business	
BIS 415	Capstone Project	
BIS 458	Data Management for Managers	
BUAN 446	Python Applications for Business	3
BUAN 448	Predictive Analytics in Business	3
BUAN 452	Business Analytics and Modelling	3
BUAN 457	Artificial Intelligence for Business	3
BIS 497 Introduction to Data Science OR		
DSCI 310 Introduction to Data Science		
ELECTIVES		**9**
Choose 9 credit hours from the approved elective list or electives as approved by Program Management		

The M.S. in Business Analytics Director must approve all elective coursework outside of the stated courses.

PROGRAM ADMISSION REQUIREMENTS

Admission to the MSBA program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-business-analytics/admissions-information/) will be based on the applicants essay, resume or CV, transcripts, 2 letters of recommendation, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. An interview may be required. Students must not have more than 2 years of professional work experience to be eligible. International students must show English proficiency. (https://business.lehigh.edu/graduate/english-language-proficiency/)

Further information about the M.S. in Business Analytics Program may be obtained by contacting Dr. Dawei (David) Zhang, Faculty Director M.S. in Business Analytics Program, at (610) 758-4225 / daz215@lehigh.edu, or Alyssa Clapp, Program

Director M.S. in Business Analytics Program, at (610) 758-2353 / alcb@lehigh.edu.

Questions? Contact us (p. 299) or visit our website: business.lehigh.edu/msba (https://business.lehigh.edu/academics/graduate/masters-programs/ms-business-analytics/)

MASTER OF SCIENCE IN MANAGEMENT

The M.S. in Management (M^2) is a lock-step cohort based degree with a prescribed course of study. The program is designed to build core business education onto the foundation of a liberal arts or STEM degree. Students have the option to complete the program full time over two semesters (9 months) or three semesters (less than 18 months). All members of the M.S. in Management community are required to attend a mandatory academic and professional orientation the week before the Fall semester begins. M^2 prepares students with liberal arts or STEM undergraduate education to enter the workforce and ready to hit the ground running from day one. Eligible applicants are college seniors or recent (one year out) graduates without undergraduate business degrees or majors. Economics majors are welcome. College calculus is helpful but not mandatory for admission.

Students will have classes that include accounting, finance, statistics, management, economics, and marketing. The program is structured to provide classroom instruction in the fall and spring semesters. In addition, a strong focus on professional development and career preparation is emphasized throughout the duration of the program that include career exploration (such as trips to New York and Philadelphia), and workshops emphasizing career readiness skills with themes of career and self-development and leadership. During the January intersession, students will have the opportunity to have an optional experiential engagement through internships, consulting projects, and/or international immersion experiences.

ACCT 442	Financial Reporting and Analysis	2
ACCT 444	Accounting for Decision Making	2
BIS 423	Management Information Systems	2
BIS 456	Business Analytics for Decision Making	3
ECO 427	Statistical Analysis for Management	2
ECO 448	Business Economics	3
FIN 418	Principles of Corporate Finance and Investments	3
GBUS 405	Career and Professional Development I	1
LAW 417	Regulatory Environment of Business	2
MGT 416	Managing Talent	3
MGT 462	Experiential Learning Capstone	3
MKT 415	Marketing Foundations	3
MKT 425	Contemporary Topics in Marketing	2
SCM 423	Supply Chain Operations Management	2
Total Credits		**33**

PROGRAM ADMISSION REQUIREMENTS

Admission to the MiM program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-management/admissions-information/) will be based on the applicants essay, resume or CV, transcripts, 2 letters of recommendation, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. Students must not have more than 1 year professional work experience to be eligible. International students must show English proficiency. (https://business.lehigh.edu/graduate/english-language-proficiency/)

Further information about the MS in Management program may be obtained by contacting Alyssa Clapp, Program Director M.S. in Management Program, at (610) 758-2353 / alcb@lehigh.edu.

Questions? Contact us (p. 299) or visit our website: business.lehigh.edu/mim (https://business.lehigh.edu/ms-management/)

DOCTOR OF PHILOSOPHY

Program Requirements

The Ph.D. program requires a minimum of 48 credit hours of study (including dissertation) beyond a master's degree or 72 credit hours of study beyond a bachelor's degree. Each student is required to choose one primary field and one secondary field of specialization. Students must take and complete with satisfactory grades core courses in microeconomic theory, macroeconomic theory, econometrics, and mathematical economics. Students are also required to pass written qualifying examinations in microeconomic theory and econometrics as well as a field exam in their primary field.

PROGRAM ADMISSION REQUIREMENTS

Admission to the Ph.D. program (https://business.lehigh.edu/academics/graduate/phd-program/business-and-economics/admissions-information/)will be based on the applicants essay, resume or CV, transcripts, letters of recommendation, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. International students must show English proficiency.

CourseWORK

In order to advance to Ph.D. candidacy, a student must complete, under the guidance of a faculty, an original third-year research paper no later than the end of their third year in the program. Under the guidance of a dissertation committee, which typically consists of a chairperson (the main advisor) and three committee members one of which being an external member sought outside the Economics Department, a Ph.D. candidate undertakes research culminating in a doctoral dissertation. The Ph.D. is awarded upon the successful completion of the dissertation and its oral defense.

Further information about the Ph.D. program may be obtained by contacting Ahmed Rahman, Ph.D. in Business and Economics Program Director, at (610) 758-2750 / asr418@lehigh.edu.

Visit our website: business.lehigh.edu/phd (https://business.lehigh.edu/phd-business-and-economics/)

CONTACT US

College of Business, Graduate Programs Office
Business Innovation Building, Suite 201
201 E. Packer Avenue, Bethlehem, PA. 18015
Phone 610-758-4450 / Email business@lehigh.edu

Business Analytics Courses

BUAN 446 Python Applications for Business 3 Credits

This class is designed to introduce students to the processes involved in acquiring, cleaning, arranging, analyzing, and visualizing business data using the Python programming language. It will be fast-paced, but assumes only a basic familiarity with coding, and requires no specific expertise in Python to start. Students cannot receive credit for both BUAN 346 and BUAN 446.

BUAN 448 Predictive Analytics in Business 3 Credits

The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics; and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data-visualization and data reduction techniques. Not available to students who have credit for BUAN 348 or BIS 456.

BUAN 452 Business Analytics and Modelling 3 Credits

This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BUAN 352 and BUAN 452.

Prerequisites: ECO 045 or BUEC

BUAN 457 Artificial Intelligence for Business 3 Credits
This course covers fundamental concepts of artificial intelligence (AI) and how it is applied to solve business problems, to increase business value, transform businesses and to gain competitive advantage. A brief technical overview will be covered. Common machine learning (ML) algorithms will be covered and students will have hands-on experience with AI tools/frameworks. Example use cases of these ML algorithms in various business functional areas will be examined. Finally, ethical challenges in the AI context will be explored.
Prerequisites: BUAN 446

Business Information Systems Courses

BIS 411 Storytelling in Business Analytics 1.5 Credit
Focuses on training students to visualize business data and communicate implications from business data through visualization and storytelling. Covers techniques and algorithms for creating effective visualizations of complex business data. Students will implement data analysis and visualization through hands-on programming and visualization tools. Enhances students' business communications related to data. Students will translate data and analysis into narratives that provide context for their messages and make persuasive recommendations in written and oral formats.

BIS 412 Data Ethics and Security in Business 1.5 Credit
Focuses on the management of data security, the frameworks of business data ethics, and the integration of data ethics with data security management. Students will be introduced to critical security principles that enable them to plan, develop, and perform data security tasks. Addresses business ethics as it relates to a variety of data management issues.

BIS 415 Capstone Project 3 Credits
The capstone project course immerses students in projects on how business analytics skills can be applied ethically in an organization to create business value. Built on the foundational courses in business analytics, the capstone integrates classroom lectures with a combination of company visits and externship projects.

BIS 423 Management Information Systems 2 Credits
This course examines the role of information systems (IS) and information technology (IT) in the organization. The focus of the course is the organizational uses of IS and IT to compete effectively. Both technical and managerial aspects of information systems are explored. The course includes technical infrastructure, management decision-making, trends and innovations in IS, and business process issues critical to the understanding of operational and strategic information systems.

BIS 434 Decision Analytics for Managers 3 Credits
This course focuses on the key concepts and methods that relate to information management and business decision making, and how managers can create value and make better business decisions by turning information into competitive advantage. It also introduces fundamental concepts and analytic methods in business analytics. In addition, this course provides an overview of how modern information systems support business decision making as well as technology-enabled business models.
Prerequisites: (ECO 045 or BUEC) and MGT 431
Can be taken Concurrently: MGT 431

BIS 456 Business Analytics for Decision Making 3 Credits
Provides students with a theoretical and practical understanding of core data analytics concepts and techniques, and develops hands-on experience in applying these techniques to practical real-word business problems using R software. As an applied course, the emphasis will be less on the inner working of each method and more on when and how to use each technique and how to interpret the results. Not available to students who have credit for BIS 348, 448, 352 or 452.
Prerequisites: MBA 440 or ECO 045 or ECO 427 or BUEC

BIS 458 Data Management for Managers 3 Credits
Covers fundamentals of database management, including database development, processing, logical and physical design, access, implementation and administration, and design and deployment of cloud services solutions. Students will gain extensive experience in developing data models, creating relational databases, formulating and executing complex queries, and understanding cloud services solutions in cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. Hands-on experiences such as such as Oracle Database and Amazon Web Services are included.

Economics Courses

ECO 402 Managerial Economics 3 Credits
Application of economic and statistical analysis to managerial decision-making. Business and economic forecasting. Empirical estimation of demand, production, and cost functions. Resource allocation and pricing strategies in various market structures. Decisions under risk and uncertainty. Government regulation of business cases.
Prerequisites: MATH 021 and (MATH 022 or MATH 096) and ECO 401

ECO 403 Econometric Software 3 Credits
The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Students will develop data management and programming skills using the Stata or SAS system. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course, students will be able to manage data to boost their research and analysis skills.

ECO 404 Applied Microeconometrics 3 Credits
The purpose of this course is to expose students to econometric techniques frequently used in applied microeconomic research. The course features critical reading of empirical research papers and the implementation of econometric methods on actual data sets.

ECO 409 Money, Banking and Macroeconomic Analysis 2 Credits
The role of financial intermediation in the U.S. economy, the process of money creation, impacts of fiscal and/or monetary policy on the goals of macroeconomic policy, inflation and unemployment.

ECO 412 Mathematical Economics 3 Credits
Applications of various mathematical techniques in the formation and development of economic concepts and theories. Consent of instructor required.

ECO 413 Advanced Microeconomics Analysis 3 Credits
A survey of methods of decision-making at the microeconomic level; price theory and econometric applications.

ECO 414 Advanced Topics in Microeconomics 3 Credits
Resource allocation and price determination. Theories of choice of consumers, firms, and resource owners under various market forms.
Prerequisites: ECO 413

ECO 415 Econometrics I 3 Credits
Computer applications of standard econometric techniques using regression analysis in a single-equation context. Discussion of problems of multicollinearity, heteroscedasticity and autocorrelation. An introduction to simultaneous equation models, identification and estimation problems.

ECO 416 Econometrics II 3 Credits
Mathematical and statistical specification of economic models. Statistical estimation and tests of parameters in single and multiple equation models. Prediction and tests of structural change.
Prerequisites: ECO 415

ECO 417 Advanced Macroeconomic Analysis 3 Credits
This course aims to familiarize students with the current research in modern empirical macroeconomics, with emphasis on the intersection of theoretical models and macroeconomic policy analysis.

ECO 418 Advanced Topics in Macroeconomics 3 Credits
Models of employment, income and growth in monetary economies. Policies for economic stability and growth.
Prerequisites: ECO 417

ECO 425 Cost-Benefit Analysis 3 Credits
Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; rationale(s) for government intervention in free market economies; proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques and distributional consequences.
Prerequisites: ECO 402 and ECO 415

ECO 427 Statistical Analysis for Management 2 Credits
Descriptive statistical measures, probability and probability distributions, statistical inference (estimation and hypothesis testing), correlation and regression. EXCEL will be used for statistical computing.

ECO 428 (ECE 428) Electricity Economics 3 Credits
Course focuses on the intersection between economics & electricity systems, and market structures available in the electric energy industry. Background provided on basic economic theory applied to power systems to understand operations objectives, pricing & incentives, as well as non-perfect competition situations that arise in the network. Different dispatch optimization problems used in electricity market restructuring, approaches to solving these, and the existence of non-convex markets will be discussed. Credit will not be given for both ECO/ECE328 and ECO/ECE428.

ECO 430 Public Finance 3 Credits
The economics of public spending and taxation; principles of government debt management; theories of budgeting and cost-benefit analysis and public choice.

ECO 431 Quantitative Market Analysis 3 Credits
The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Students cannot receive credit for both ECO 366 and ECO431.

ECO 440 Labor Economics I 3 Credits
The economics of labor markets and various labor-market institutions with emphasis on current theoretical and empirical research. Topics include labor supply and demand, human capital, the structure of labor markets, labor market regulation, information and job search, labor mobility, unionism, and labor market discrimination.
Prerequisites: ECO 401 and ECO 402

ECO 441 Labor Economics II 3 Credits
An examination of empirical research in labor economics, focusing on topics such as human resource management and internal labor market outcomes, wage and income inequality, and poverty, unemployment, and other issues current in the literature.
Prerequisites: ECO 415

ECO 447 Economic Analysis of Market Competition 3 Credits
Mathematical models based on game theory and industrial organization. Cases are used to analyze the strategic interaction of firms and governments as competitors and partners.
Prerequisites: ECO 402

ECO 448 Business Economics 3 Credits
Applications of economic analysis to business decision-making; technology in economic systems; resource allocation and pricing strategies in various market structures; decisions under risk and uncertainty; and government regulation and support of business and innovation.

ECO 452 Behavioral Economics 3 Credits
The study of human behavior in economic contexts incorporating ideas from Psychology and other disciplines. Covers both theory and applications. Topics include non-standard preferences (e.g., loss-aversion), decisions under risk, intertemporal choices, heuristics and biases, and more.

ECO 455 Health Economics I 3 Credits
Economic theory and empirical analysis of health production, the demand for health services, and health insurance. Implications for the current institutional structure of health care and health delivery systems will also be discussed. Additional topics and extensions will be selected based on developments in the literature.
Prerequisites: ECO 416

ECO 456 Industrial Organization 3 Credits
The goal of the course is to review theoretical and empirical attempts by economists to understand market structures lying between the extremes of perfect competition and monopoly. The course will focus first on describing the current U.S. industrial structure and reviewing models of imperfect competition. The course then shifts to a closer study of individual firm behavior. The final segment of the course is an overview of two significant relationships between government and industry caused by the existence of imperfect.
Prerequisites: ECO 415 and ECO 447

ECO 460 Time Series Analysis 3 Credits
Classical decomposition of time series, trend analysis, exponential smoothing, spectral analysis and Box-Jenkins autoregressive and moving average methods.

ECO 463 Topics in Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations. Topics include normal-form and extensive-form representations of games, various types of equilibrium requirements, the existence and characterization of equilibria, and mechanism design. The analysis is applied to micro-economic problems including industrial organization, inter-national trade, and finance.

ECO 464 Applied Econometrics I 3 Credits
This course focuses on the identification of causal relationships using cross-sectional and panel data. The objectives are to 1) familiarize students with identification assumptions for causal inference; and 2) enable students to select appropriate econometric tools for empirical economic problems and policy evaluation.Topics include robust inference and bootstrap; instrumental variables and generalized method of moments (GMM); quantile and nonparametric regression methods; treatment effect analysis, and models for discrete choices, panel data, and social interactions.
Prerequisites: ECO 416

ECO 465 Applied Econometrics II 3 Credits
Econometric analysis of skewed and truncated distributions, discrete outcomes, and missing or incomplete data. The first part of this course will involve the functional specification and testing of appropriate estimators in these situations, while the second part of the course will focus on conducting causal inference using nonlinear models in the presence of unobserved heterogeneity. Emphasis will be given to common applications in health and labor economics.
Prerequisites: ECO 416

ECO 466 Health Economics II 3 Credits
Selected topics in the literature on health economics with an emphasis on the application and evaluation of econometric techniques and identification strategies. Both demand and supply side issues will be addressed. Examples of the former include the demand for health, health insurance and health care services, while examples of the latter include the regulation of supplier behavior and industrial organization issues.
Prerequisites: ECO 416

ECO 490 Master's Thesis 1-6 Credits
Master's Thesis.

ECO 492 Special Topics in Economics 1-3 Credits
Extended study of an approved topic not covered in scheduled courses.
Repeat Status: Course may be repeated.

ECO 493 Doctoral Pre-Dissertation Research Project - Independent Study 1-9 Credits
Independent study on a topic that is being pursued to fulfill the third year paper requirement, and has been approved by the student's interim advisor.

ECO 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Finance Courses

FIN 418 Principles of Corporate Finance and Investments 3 Credits
This course provides students with a basic foundational knowledge of finance principles, working knowledge of various aspects of corporate finance, and the principles of investments. Short-term financial decisions will be discussed. Long-term capital investment will be explored starting with the basics of time value of money and capital investment techniques. Topics include the determination of the appropriate investment discount rate, the organizationâ€™s cost of capital and hurdle rates, the risk-reward tradeoff, and specific financial instruments.

FIN 433 Financial Analysis for Managers 3 Credits
The class introduces the key elements of financial reporting, budgeting, and analysis in corporate finance decision-making. From understanding the financial statements to implementing strategic plans, operational budgets, and financial forecasts, the course prepares students to make capital-investment decisions that lead to improved financial efficiencies and operating performance.
Prerequisites: MGT 431 and GBUS 401
Can be taken Concurrently: MGT 431

Grad Business Entrepreneurship Courses

GBEN 401 Business Plan I 2 Credits
This course focuses on the need to validate that a market exists for a new product or service. As a project-based course, students work independently on a venture of their own choosing. They are challenged to make use of primary market research methods to identify demand determinants and test for the presence of first-time buyers. Students search available databases and gather information to estimate market size and growth potential.

GBEN 402 Business Plan II 2 Credits
This course focuses on the need to create a business plan to launch a new enterprise. As a project-based course, students work independently on a venture of their own choosing. Emphasis is given to all the elements needed to commercialize a new enterprise from a marketing, sales, operations, technology, facilities, and financial perspective. The presentation format of the business plan receives close attention as a tool to attract potential investors.
Prerequisites: GBEN 401

GBEN 403 Anatomy of Entrepreneurship 1 Credit
This course focuses on the personality traits and characteristics of a founder. The leadership style and management of a startup are highlighted as the venture moves through various stages of development. Real-life situations are brought into the classroom and students are challenged with decision-making in a startup environment marked by enormous uncertainty and rapid change. Students learn the critical role of the founder in attracting investors and raising capital.

GBEN 404 Market Opportunity 1 Credit
This course focuses on entrepreneurial marketing and the methods employed by emerging growth companies to successfully penetrate and disrupt markets. Speakers and cases illustrate branding strategies, selling approaches, pricing alternatives, and digital marketing tactics peculiar to startups who are constrained by scarce resources and saddled with expertise in the hands of a few.

GBEN 405 Intellectual Property 1 Credit
This course focuses on IP strategy and valuation with emphasis on the technology-driven startup. Early stage companies must demonstrate proof-of-concept to their investors, a huge milestone that verifies the potential of real-world application. Speakers and cases deal with the harsh trade-offs of IP decision-making and the constant need to raise capital to accelerate technology development.

GBEN 406 Performing Due Diligence 1 Credit
This course focuses on due diligence as a creative and time-sensitive process that can open or close doors for startups. Speakers and cases illustrate what potential investors or acquirers do to validate the accuracy, integrity, and completeness of information provided before finalizing an investment decision. Students learn performing due diligence is a labor-intensive investigative process that unfolds in stages where the results also speak to the credibility of the entrepreneur.

GBEN 407 Startups & Pivots 1 Credit
This course focuses on the need to pivot, or shift direction, when market conditions and revenue shortfalls dictate major change. Speakers and cases highlight what startups do to breathe new life into a troubled venture. Students learn how founders raise capital under adverse circumstances in order to buy time to re-configure product, transition to another market and type of customer, and test a new business model.

GBEN 409 Financial Forecasting 1 Credit
This course focuses on the use of pro forma financial statements and projections to value and finance an early stage company. Cases illustrate key assumptions and various scenarios that figure into a multi-year forecast. Business models are evaluated for their profit potential during a period of expansion and growth. Students learn the art and science of valuing a startup.

GBEN 410 Financing Startups 1 Credit
This course focuses on the separate but overlapping worlds of angel investors, venture capitalists, and strategic investors. Their funding role, investment objectives, and market behaviors are analyzed in capital raises for seed through late stage companies. Cases give attention to venture capital and their term sheets. The course culminates in a simulated deal negotiation involving students.

GBEN 412 Going Public 1 Credit
The course focuses on the initial public offering [IPO] or how the venture capital-backed company moves from being privately-held to publicly-held. Major emphasis is placed on the role of the investment banker and the workings of the Securities & Exchange Commission [SEC]. Actual IPOs traded on the NYSE or NASDAQ are dissected from every angle before, during, and after a company goes public.

GBEN 413 Integrative Experience/New Venture Internship 1-4 Credits
Only students enrolled in the Entrepreneurial concentration may elect one of these hands-on, project-orientated s. Integrative Experience must meet the requirements of formal independent study and involve a new venture situation with a startup or existing company. Students employed in a New Venture Internship may also qualify for credit if the same requirements are satisfied.

GBEN 414 Ventures in Brand Licensing 1 Credit
This course focuses on the art and science of building new enterprises by utilizing licensing strategies to leverage the power and influence of brands. A wide cross-section of deal structures and negotiation strategies are explored. Key elements of a licensing contract are dissected from a market, economic, and legal perspective. The approach to learning is hands-on with speakers, interactive exercises, and real-life situations shedding light on the emergence of brand licensing as an alternative path to new venture creation.

GBEN 415 LehighSiliconValley 1-3 Credits
Immersion study-abroad-like program focused on venture capital-backed companies and the paths taken to start, build, and exit an enterprise. Offered in the hub of entrepreneurship, Silicon Valley, live cases draw on seasoned practitioners from all reaches of the venture community. Students strategically analyze and evaluate startups, lead discussion, and assess team performance in recommending go-forward strategies. Emphasis on real companies, real players, and real situations in real time create a highly charged learning environment. Winter term. Includes pre-trip sessions. Competitive admission. Program fees.

GBEN 424 Entrepreneurship & Innovation: From Idea to Opportunity 3 Credits
Thought about starting a business but wonder where to begin? focuses on the idea stage of new venture creation where discovery plants seeds of future enterprises. Student projects, case studies and speakers introduce personal, interpersonal, financial, and legal challenges startups encounter. Drawing on research on entrepreneurial decision-making, students learn to think and behave entrepreneurially. Participants "kick the tires" on their own and others' just-emerging ideas and improve them. For those interested in starting a business sometime in their lives.

GBEN 492 Special Topics 1-3 Credits

GBEN 497 1-3 Credits
Repeat Status: Course may be repeated.

Graduate Business Courses

GBUS 401 Financial Reporting for Managers and Investors 3 Credits
Corporate financial reporting under Generally Accepted Accounting Principles. Analysis and interpretation of financial statements: accrual accounting, balance sheet valuation, income determination and cash flow analysis.Profit manipulation, window dressing and "creative accounting" through accounting policy choices. Fraudulent financial reporting, uses and limitations of accounting information. Accounting information as a tool for strategic decision making.

GBUS 405 Career and Professional Development I 1 Credit
Enables foundations to navigate career journeys and transition into the workforce. Focuses on strengths, interests, personal leadership, strategic communication, and professional networking. Includes business content, exercises, facilitation, readings, assignments, and thought leadership. Students must show progress toward crafting their professional profile and presenting to networks and employers through required and completed course deliverables and activities that tie into the course's learning objectives and build upon course-related activities such as mock interviews, Career Expo, etc.

GBUS 408 Advanced Business Speaking and Pragmatics 2 Credits
Designed to assist international business students become capable communicators within the U.S. and the global marketplace. Students will increase their oral communicative competence and socio-cultural communication awareness through assignments designed to help them learn successful behaviors and customs that are essential elements of oral communication in U.S. graduate business courses, job searching, networking, business presentations, and career development. Students are assessed through their successful use of advanced language functions during the application of face-to-face business settings including business-style negotiations, interviews, presentations, and panel discussions.

GBUS 409 Advanced Business Writing and Reading 2 Credits
Designed to introduce international business students to the types of rhetoric and written structures required in an American university graduate business program, as well as in most business environments; and to provide them with the skills and strategies that are necessary to produce cogent academic essays and papers, as well as business summaries and briefs for the global marketplace. Utilizing a process writing approach, students model expository, chronological order/process, compare and contrast, cause and effect, argumentative, and problem-solution styles, as well as formal and informal business written communication styles. Students are assessed through their successful use of these rhetorical models in writing, their advanced level of academic vocabulary and grammatical structures, as well as through summaries and analyses of research-level articles that include appropriate academic publication conventions.

GBUS 413 Advanced Management Accounting 3 Credits
Issues in management accounting including activity-based costing, activity-based management, strategic cost management, theory of constraints, advanced manufacturing technologies, cost of quality and lifecycle costing. Readings and cases.
Prerequisites: MBA 403

GBUS 414 Financial Statement Analysis and Interpretation 3 Credits
This course focuses on analysis of financial statements. It develops the skills necessary to interpret and use financial statement information effectively to assess profitability and risk and is intended for individuals likely to become intensive users of financial accounting information. Requirements include readings, case studies, presentations, and written analysis of actual financial statements.
Prerequisites: (MBA 402) or (ACCT 151 and FIN 125 or FIN 225)

GBUS 419 Financial Management 3 Credits
An intermediate level course in corporate finance. Coverage includes capital budgeting techniques including real options, decision tree analysis, risk analysis, advanced cost of capital theories, capital structure theory, dividend policy, working capital management, mergers and acquisitions, restructuring, and bankruptcies. The course emphasizes both theory and practice through lectures, cases, and financial modeling exercises. Students not possessing the relevant prerequisites must obtain waivers from the designated finance faculty representative.
Prerequisites: MBA 402 or MBA 461 or FIN 433 or (ACCT 151 and FIN 125)

GBUS 420 Investments 3 Credits
A survey course in investments. Overview of financial institutions and markets involved in the issuance and trading of securities. Emphasis on valuation and risk assessment of fixed income and equity securities. Construction of optimal portfolios and examination of performance measures. Students not possessing the relevant prerequisites must obtain waivers from the designated finance faculty representative.
Prerequisites: MBA 402 or MBA 461 or FIN 433 or (ACCT 151 and FIN 125)

GBUS 421 Advanced Investments 3 Credits
Advanced topics relating to specific areas within investment finance such as valuation/security analysis; portfolio/risk mamangement; fixed investment securities;mutual funds; hedge funds; microstructure; and trading. Consent of designated finance faculty representative required.
Repeat Status: Course may be repeated.
Prerequisites: GBUS 420

GBUS 422 Derivatives and Risk Management 3 Credits
The theory and application of a variety of derivative instruments (options, futures contracts, etc.) used in corporation finance and the financial services industry. The focus is on the risk management application vs. a rigorous development of option pricing theory and similar topics. Consent of designated finance faculty representative required.
Prerequisites: GBUS 420

GBUS 424 Advanced Topics in Financial Management 3 Credits
Advanced topics relating to specific areas of corporate finance such as: theoretical and empirical examination of recent developments in financial management, asset valuation and capital budgeting including the role of uncertainty, imprecise forecasts, risk preferences, inflation, market conditions, and the global marketplace, working capital management, leasing, mergers, and financing. The course content may vary between instructors or each time the course is offered. Consent of designated finance representative.
Repeat Status: Course may be repeated.
Prerequisites: GBUS 419

GBUS 425 Real Estate Financing and Investing 3 Credits
An upper-level course in modern real estate financing techniques from the perspectives of both the borrower and the lender. Subject matter encompasses the following areas: The principles of financing decisions; financing methods and techniques; institutional sources of funds for real estate; and real estate financing decisions. Consent of designated finance faculty representative required.
Prerequisites: (MBA 402 and GBUS 420)

GBUS 426 Financial Markets and Institutions 3 Credits
Functions and portfolios of financial intermediaries. Sectional demand and supply of funds, nature and role of interest rates, term structure and forecasting, impact of inflation and regulations on financial intermediaries and markets, and current developments in the financial system. Management of assets and liabilities within the U.S. financial institution's legal and economic constraints. Consent of designated finance faculty representative.
Prerequisites: (GBUS 420)

GBUS 431 Quantitative Finance 3 Credits
Relationship of quantitative models to financial theory and applications. Capital budgeting, portfolio selection, security evaluation, cash management, inventory policy and credit analysis. Consent of designated finance faculty.
Prerequisites: MBA 402

GBUS 432 Demand and Supply Chain Planning 3 Credits
Students will learn how businesses work together to build relationships and integrate demand and supply planning activities across the supply chain to deliver superior value to customers. They will also learn about tools and technologies that enable integration as well as the critical drivers and the key metrics that support supply chain performance. Current readings and case studies, simulations and written assignments will be used.

GBUS 437 Federal Taxation and Business Decisions 3 Credits
Impact of federal taxation on the structure and timing of business decisions. Problem-solving methods and research techniques from a managerial perspective.
Prerequisites: ACCT 307

GBUS 441 Business Ethics 3 Credits
Presents several frameworks by which to view ethics and decision-making. Links theory and practice through the study of business ethics as it relates to a variety of management issues. Course content is structured along three dimensions: ethics and the individual, managing ethics in the organization, and organizational ethics and social responsibility.

GBUS 442 Seminar in Management Consulting 3 Credits
A study of consulting practices in general and their application to small business. Processes include a field study/counseling service to a local business. Emphasis is on the identification and analysis of multidisciplinary problems and opportunities and the implementation of recommendations. Must have completion of MBA background courses (or equivalent). Consent of instructor required.

GBUS 443 Advanced Leadership Topics: Leadership Skill Building 1 Credit
Beyond intelligence and technical skills, what separates effective from less effective leaders is an understanding of the human psychology that drives business. This course offers students an opportunity to learn more about themselves, to get feedback, to practice getting out of their comfort zones. It focuses on providing students with essential leadership knowledge and abilities, including topics at the heart of relational leadership (e.g, listening, coaching, feedback giving/receiving, EI) to grow into the leader they want to become.

GBUS 447 Negotiation 3 Credits
The class examines the behavioral foundations of the negotiation process. Topics include: The negotiation process, negotiation planning, power in negotiations, communications in negotiations, tactics, concepts of win-win and win-lose, social styles, individual and team negotiations, ethical considerations, cultural differences, negotiating in sole source (customer) situations, using third parties. The concepts will be exposed through both lectures and simulations.

GBUS 448 Leadership 3 Credits
This course is an examination of leadership at the organization and group/team levels, and aims to develop and build a student's leadership skills and the ability to diagnose leadership needs in different situations. In identifying and building these leadership skills, the course will focus on the decisions leaders need to make, and the appropriate leadership decision-making processes required in various contexts and at different stages of an organization's existence. Cases and developmental exercises including in-depth decision-making exercises are utilized and cover diverse situations and cross-cultural dimensions including specific situations such as a crisis or ethically difficult decisions.

GBUS 449 Talent Analytics 3 Credits
Addresses the growing need for data-driven, analytical approaches to managing talent. To implement business strategies effectively and to gain competitive advantage through people, leaders must deal with people issues. The organizations that will win the “war for talent” will be those, which are better at identifying and keeping key talent, motivating high performance, developing and promoting staff, and predicting future people needs accurately. HR professionals need analytics to address these challenges.
Prerequisites: MBA 405 or MGT 436 or MBA 464

GBUS 450 Strategic Supply Management 3 Credits
A survey course designed to introduce the MBA/MSE student to the vital role played by supply management in achieving overall effectiveness for the firm in today's global economy. The course starts by examining the traditional purchasing process and then moves on to an examination of the evolution of purchasing into supply management and, finally, to the role purchasing plays in improving effectiveness of the entire value chain. consists of lectures, discussion and case analysis.

GBUS 453 Transportation and Logistics Management 3 Credits
The control of physical distribution and inventories; the flow of information, products and cash through the integrated supply chain.

GBUS 456 Applied Supply Chain Models 3 Credits
This course will present applied and analytic approaches for developing inventory and forecasting models, supplier selection, supply chain quality management, and production planning and supply chain network design.

GBUS 460 Strategic Marketing Management 3 Credits
The course studies the management of contemporary organizations from the perspective of a marketing manager. While the course content addresses the activities required to maintain a strategic fit between an organization's environment and its particular set of objectives and resources, the central focus is on designing strategic marketing actions for various types of organizations. The course pedagogy emphasizes the application of marketing and other business principles through seminars, simulations, or case discussion.
Prerequisites: MBA 404

GBUS 461 Marketing Analytics 3 Credits
With principles of marketing as its underpinning, this course provides an overview of both theories and practice of marketing analytics. Topics and skill sets include customer data, machine learning, artificial intelligence, search engine marketing, digital metrics, dataset queries, statistical programming, text analysis, and data visualization. Through class discussions and hands-on exercises, students will gain a basic understanding and working knowledge of analytics, allowing them to make strategic decisions and derive customer insights to support businesses in today’s data-driven world.

GBUS 462 Pharmaceutical Marketing 3 Credits
The course provides an introduction and overview of the various healthcare system components as they relate to the pharmaceutical industry. This course will (1) focus on product decisions of the firm, requiring an occasional shift in focus from that of corporate management to that of operating managers of new product activities or established brands; (2) recognize the importance of marketing research as input to product decisions; (3) take a managerial orientation; (4) recognize the need to tailor product policy approaches to the characteristics of the decision-maker and the firm. The course will be a mixture of lectures, discussions, case analyses, and group exercises. Graduate students only.
Prerequisites: MBA 404

GBUS 464 Business-to-Business Marketing 3 Credits
This course focuses on marketing strategies and tactics in firms whose customers are other institutions, not individuals. Topics covered include organizational buying behavior, managing strategic buyer-seller relationships, sales force deployment, communication strategies, and so on. Specific attention is given to the impact of information technology and globalization in the business to business context.

GBUS 465 Creating Breakthrough Innovations 3 Credits
Most products and services either fail or do average business, but some are phenomenally successful. Such products and services that provide phenomenal financial returns and become market leaders can be called "Breakthrough Products and Services". The main objective of the course is to improve our understanding of the process of creating breakthrough products and services. It is accomplished by in-class discussions of cases, assignments, and the state-of-the-art research work in academia and industry. The course concludes with a term paper that integrates the concepts learned from class discussions, reference books, and research papers and applies them to a real product. Must have graduate student status plus two years of postgraduate work experience.

GBUS 466 Marketing Research and Analysis 3 Credits
This course focuses on procedures for collecting and analyzing relevant information for informed decision making by managers. The process of identifying research questions, developing instruments for collecting information, appropriate interpretation of information, and appropriateness of research methods are some of the topics discussed in this course. The course focuses on the process of doing marketing research as well as the techniques for analyzing information. Discussion of concepts and cases, developing data collection instruments, and doing actual marketing research projects will form the key elements of this course.
Prerequisites: (ECO 401 or BUEC)

GBUS 467 Sales Management 3 Credits
This course takes an integrated approach to the study of sales management, including formulation of strategically sound programs and the implementation of selling initiatives and the evaluation and control of the organization’s sales activities. Topics include the role of the sales manager in the divergent demands of multiple constituencies; the development of effective sales organizations; lead generation and quota setting; territory management; and motivation and reward systems. Learning methods include case studies where students’ diagnose problems and develop viable alternatives.

GBUS 468 Future of Marketing 3 Credits
The course focuses on emerging trends that significantly influence the future of marketing. A variety of methods and contemporary materials will be used to discuss future scenarios: (1) how marketing is conceptualized and implemented; and (2) how marketing impacts and is impacted by society.

GBUS 470 Marketing Communications Strategies 3 Credits
This course focuses on how various elements of communications are integrated to achieve various organizational objectives. In addition to the traditional communication media such as advertising and point of purchase media, emphasis will also be placed on new media and strategies made possible due to the advances in technology. The course will involve discussion of concepts, case analysis and discussion, insights from practitioners, and group projects.

GBUS 471 Strategic Brand Management 3 Credits
This course approaches the study of brand management by illustrating the formulation of strategically sound brand management programs and the evaluation and control of the implementation of key brand initiatives (new products, advertising support, etc.). Focus is on theories and models to develop and manage brand equity. Specific learning modules include customer development, brand strategy development, brand extension development and annual brand planning. Specific attention is focused on case studies and team projects in building, measuring and managing brand equity.

GBUS 472 Strategies for Services Marketing 3 Credits
The course focuses on the challenges of marketing and managing services (whether in a manufacturing or service business) and discusses the development of strategies for addressing these challenges. The need for cross-functional integration to provide effective service is stressed. Illustrative topics include service quality gap analysis, relationship between superior service and profitability, service encounter analysis, customer lifetime value analysis, services guarantees, and service demand and capacity management.

GBUS 473 International Finance 3 Credits
Consideration of problems arising from the risks associated with international investing and multinational corporation finance (currency, political, etc.). Focus is on (a) investing in international market given the institutional constraints and differences between domestic markets, and (b) managerial issues relating to corporations, investors, and financial institutions. Consent of designated finance faculty representative.
Prerequisites: GBUS 419

GBUS 475 Global Marketing Strategies 3 Credits
The course is designed to provide a framework within which global marketing operation can be analyzed, understood, and undertaken. The course focuses on issues that are being faced by firms in today's global marketplace, particularly those that are related to strategy formulation and implementation. The learning experience in this course is placed on global business decision-making, through the use of case studies, projects, exercises, and lectures.

GBUS 482 Financial Engineering Professional Development I 1 Credit
MFE alumni speakers provide weekly insights on coding languages and industry trends. Preparations for placement in internships and full-time positions are undertaken for finance and data science positions. Students must show progress toward crafting their professional profile and are required to submit bi-weekly summaries of completed course activities that tie into the learning objectives of the course and build upon prior course activities to advance job preparations and career foundations.

GBUS 483 Financial Engineering Professional Development II 1 Credit
MFE speakers provide insights into job search strategies and current job opportunities. Mock interviews and further preparation targeted to tracks (Trading, Data Analytics, Advisory, Risk), prepare students for targeted interviews. Students must show progress toward crafting their professional profile and are required to submit bi-weekly summaries of completed course activities that tie into the learning objectives of the course and build upon prior course activities to advance job preparations and career foundations.
Prerequisites: GBUS 482

GBUS 484 Financial Engineering Professional Development 0 Credits
The program's size and selectivity lead to an intense experience enabling the student to benefit from development opportunities such as: Alumni Connections, Alumni speaker series, corporate connections gained through practicum capstone projects, standard University job tools and programs, Quant Career fairs, Quant Trading Competition, Quant Conference and Networking, internships and job opportunities.
Repeat Status: Course may be repeated.

GBUS 485 Financial Engineering Practicum Capstone I 2 Credits
MFE students work in teams with a faculty mentor on the scoping, reach, coding, and technical feasibility of portfolio theory-based tools, risk management models, trading algorithms, or blockchain-based trading strategies initiated by the course's corporate sponsors. Projects can be initiated by enterprising students. These sponsors are asset managers, algorithmic traders, blockchain professionals, bankers, published authors, investor advisors to ensure that the projects have real-world applicability. Written reports and oral presentations to sponsors are required. Open to MFE students only.

GBUS 487 Financial Engineering Practicum Capstone II 2 Credits
MFE students continue to work on team projects designed in GBUS 485 via conference participation, reaching to experts in the field, further developing their coding, risk assessment skills. Written reports and oral presentations to sponsors are required. Open to MFE students only. Class meets every week while periodic team meetings with and without sponsors are also held.
Prerequisites: GBUS 485

GBUS 490 Thesis 0-6 Credits

GBUS 492 Special Topics 1-4 Credits
Repeat Status: Course may be repeated.

GBUS 494 Field Projects 1-4 Credits
The field projects course will provide MBA students with an opportunity to apply MBA concepts with an employer, corporate partner or other suitable organization. Students will work with a supervising professor and a corporate representative on a project designed by the student. Students must prepare a written proposal for the project including the expected outcomes and an estimate of the hours required for completion. Students will present their proposal to a faculty member of their choice for approval. The academic rigor and time required to complete the project will determine the number of credits earned.

GBUS 499 Dissertation 1-12 Credits

Graduate MBA Core Courses

MBA 401 Introduction to the Organization and its Environment 2 Credits
An MBA core course designed to provide a thorough understanding of business organizations by examining strategies middle and senior managers use to create and sustain organizational competitive advantage. The course examines the organization from an overall perspective within the context of the firm's internal and external environment. The second aspect of this course deals with the ability to communicate effectively in today's business and professional environment. Students will examine and practice the written and verbal communications strategies and skills that are essential to their success in business.

MBA 402 Managing Financial and Physical Resources 4 Credits
An MBA core course designed to integrate financial and managerial concepts into operations decisions. Disciplines of accounting, finance and economics are combined to provide substantive foundations for discussing and analyzing data. Implications of analysis are applied to facilitate decision-making in other areas such as marketing, operations (manufacturing, logistics and engineering), human resources, information technology and general management. The major learning objectives will be applied through a series of "living" cases that are centered on analyzing historical financial performance, preparing a business plan, and valuing a business.
Prerequisites: (MBA 401 and GBUS 401 or BUAC)
Can be taken Concurrently: MBA 401

MBA 403 Managing Information 4 Credits
An MBA core course dealing with concepts and methods involved in the collection, organization and dissemination of information that helps managers make operational and strategic decisions. The course also deals with attributes of information and examines enterprise-wide impacts of local decisions. Revenue, cost, time and quality-based information are accorded equal emphasis, while students are exposed to alternative evaluation methods for decisions related to different parts of the value chain. Topics include: activity-based costing; activity-based management; transaction analysis; operational and strategic decisions such as outsourcing, design partnerships, etc; investment analysis for short lifecycle investments; evaluation of uncertainty, risk and ambiguity; metrics development; compensation policies; segment evaluation methods; target costing and functional analysis; quality function deployment; total cost of ownership; and transfer pricing. In addition, the course deals with: information technology enablers which allow firms to improve value delivered to customers; and evaluation and management of emerging forms of Cooperation, such as joint ventures and project based strategic alliances.
Prerequisites: (ECO 401 or BUEC) and (GBUS 401 or BUAC and MBA 401)
Can be taken Concurrently: MBA 401

MBA 404 Managing Products and Services 4 Credits
An MBA core course focusing on the management of products and services within a firm's value chain. The course addresses exceeding customer expectations, establishing total quality as the core foundation, developing a strong customer focus, creating value through supply chain management, developing new products for competitive advantage, matching aggregate supply with customer demand, and designing market channels and influencing customers.
Prerequisites: MBA 401
Can be taken Concurrently: MBA 401

MBA 405 Managing People 4 Credits
An MBA core course that examines how effective organizations are created, maintained, and improved. The course will focus on how good people are attracted to an organization and how to make them productive. Topics include: organizational design, job design, staffing, training and development, performance, teams, influence, diversity, change, ethical decision-making and current people issues facing today's organizations.
Prerequisites: MBA 401
Can be taken Concurrently: MBA 401

MBA 406 Integrative Experience 3 Credits
An MBA course where students apply the body of knowledge acquired in MBA 401 through 405 through a simulation, case presentations and the cross core project. This course places an emphasis on strategic management and takes the point of view of the general manager to view the organization from an overall perspective in the context of the firm's internal and external environment. In doing so, students examine historical perspectives, contemporary theories, and practical applications all in the spirit of helping them develop a broad understanding of strategic management issues and solutions. By combining high-level class discussions, case analyses, a computer simulation competition and the crosscore project this course exposes students to rigorous theoretical analysis while providing hands-on, simulated real world business experiences.
Prerequisites: (MBA 401 and MBA 402 and MBA 403 and MBA 404 and MBA 405)
Can be taken Concurrently: MBA 403

MBA 440 Quantitative Methods 3 Credits
The course develops an understanding of the foundational methods and skills of quantitative analysis to a variety of business and economic situations. Areas of focus include probability concepts, data description and visualization, estimation, hypothesis testing, correlation, and regression. Software packages are used for statistical computing and data analysis.

MBA 441 Professional Development 1 Credit
The course focus is on career-enhancing skills that aid professional development. Assessment tools are used to understand preferred communication styles, motivators and competencies, and facilitation of effective collaboration through high-performance team building. Networking, interviewing, presentation, and communication skills are also covered.
Repeat Status: Course may be repeated.

MBA 442 Societal Shifts I 2 Credits
This course will introduce eight societal shifts and the societal divides that each may lead to. The course explores the linkage between the Societal Shifts and the UN Sustainable Development Goals (SDGs), and focuses on three Societal Shifts in particular, Climate Change, Changing Demographics, and Rapid Urbanization, leading to a focus on Sustainable Cities (SDG 11) and Climate Action (SDG 13), and how society needs to think about sustainable growth in the coming decades.

MBA 443 Societal Shifts II 4 Credits
This course will take an in-depth look at eight societal shifts that were introduced in MBA 442. The societal shifts will be examined in pairs and then integrated to form scenarios for society in the coming decades. The focus is on the impacts of these societal shifts at the industry and individual company level.
Prerequisites: MBA 442

MBA 451 Accounting 1-MBA 1.5 Credit
This course trains students in corporate decision making using financial information that is prepared under mandated accounting principles for external financial statement users. The course also covers accounting practices which provide information for internal users. It studies the use and interpretation of financial statements with a focus on the effect of economic transactions on financial statements and key ratios. Topics include: introduction to financial accounting concepts and principles, the accounting cycle, cost accounting information processing and impact on decision making.

MBA 452 Economics and Markets 1-MBA 1.5 Credit
Fundamental principles and tools of microeconomics with a focus on managerial decision-making. Topics include consumer behavior, input selection, cost analysis, production and pricing strategies in various market structures, decision making under uncertainty, international trade, information asymmetry and organizational design, and game theory as it applies to business strategy. .

MBA 453 Finance 1-MBA 1.5 Credit
This course explores the application of fundamental finance concepts in modern business. Topics covered include Risk and return, Capital budgeting techniques and analysis, financial statement analysis and forecasting, valuation basics, corporate cost of capital, and other corporate finance issues such as capital structure, dividend policy, and working capital policy.

MBA 454 Management - OB/HR 1-MBA 1.5 Credit
This course focuses on understanding human behavior at work and how it is influenced by individual differences, group dynamics, and by the organizational context in which people are employed. Key organizational behavior theories will be applied to fundamental human resource management issues with an emphasis on aligning an organization's talent with its strategy to maximize performance. Topics will include: staffing and selection, training and development, motivation, performance management, leadership, and optimizing effectiveness by understanding behavioral factors of individuals and groups.

MBA 455 Marketing 1-MBA 1.5 Credit
This course provides a contemporary perspective to introduce the student to the fundamentals of strategic marketing. The course explores the functional marketing operations of organizations and tracks the marketing manager's decision processes including segmentation and target market development, product/brand positioning and the development of the value proposition, and the integration of the marketing mix elements into a cohesive strategy. Specific learning modules are concerned with the development, evaluation, and implementation of strategic marketing plans.

MBA 456 Strategy 1-MBA 1.5 Credit
Within the context of a multi-stakeholder approach to organizations, strategic management covers overall organizational issues in intent, analysis, strategy formulation, execution, and control within a global environment. The objectives of this course are to provide the student with a better understanding of business organizations and to clarify the way senior managers create and sustain organizational competitive advantage.

MBA 457 Consulting Practicum I 2 Credits
The course enables students to analyze and dissect strategies that speak to market leadership and growth trajectories. The format is intensely interactive. High profile consulting firms shed light on wide-ranging topics from business transformation to board governance. The public company is seen from an analyst or investor perspective. Emphasis is given to the role of CEO as chief strategist and organization builder. The classroom experience comes alive through fast-moving cases and wide-angle discussions with a host of speakers.

MBA 461 Financial Claimants 1-MBA 1.5 Credit
This course will focus on various financial claimants in the modern corporation. The focus will be on the theory behind and practice related to information needs and use by stockholders, bondholders, and other intermediate financial claimants (e.g., preferred stockholders, warrant holders). Coverage will include related governance and agency theory principles as well as the impact of disclosure, fair value accounting, and regulation on financial claimants.
Prerequisites: MBA 451 and MBA 453

MBA 462 Government & Society 1-MBA 1.5 Credit
Economic and strategic analysis of the role of government and social forces in markets and business policies. Topics include environmental controls, consumer protection, antitrust and the promotion of market competition, intellectual property and inventions, and taxation.

MBA 463 Suppliers and Customers 1-MBA 1.5 Credit
Explores how organizations identify customer needs and develop supply chain flows – upstream (backward through the supply levels) and downstream (forward through the channel systems) to deliver goods and services that exceed customer expectations and creates societal value. Covers demand/customer management, supply/capacity planning, raw material/component sourcing, inventory planning, distribution/merchandising, and quality management. Focused on how marketing and supply chain managers make decisions regarding effectiveness vs. efficiency trade-offs. Concerned with the development, evaluation, and implementation of marketing strategy and supply chain.
Prerequisites: MBA 455

MBA 464 Employees 1-MBA 1.5 Credit
This course will focus on the evolving social contract between employers and employees in the modern corporation, their causes and consequences. Topics will build on the basics from the Management OB/HR course from the first session. In particular, coverage will include the following issues: procedural justice and fairness; privacy and freedom of speech; work-life balance, diversity, inclusion, and the bottom line; job security and alternative work arrangements, compensation; employee ownership; performance management and career development.

MBA 465 Consulting Practicum II 4 Credits
Students move from the classroom setting of Consulting Practicum I to the practice or field environment in serving an actual client in Consulting Practicum II. Emphasis is placed on applying analytic, listening, and communication skills through the various stages of a client engagement that include preparation, initial meeting, proposal development, work-in-process, deliverable, and formal presentation at semester's end. The course challenges students to assume the role of management consultant in creating value through a strategic-level assignment that is time-sensitive.
Prerequisites: MBA 457

MBA 471 Accounting for Executives 3 Credits
This course incorporates both financial reporting and managerial accounting topics emphasizing the analysis and evaluation of accounting data as part of the managerial processes of planning, decision-making, and control. Topics include: financial accounting concepts and principles, cost accounting information processing and its impact on decision making and strategy development and the application of accounting information in the firm's management of ESG (environmental, social, and corporate governance) issues.

MBA 472 Essentials of Economics for Executives 3 Credits
Applications of concepts and tools of economics to broader topics such as markets and government; open-economy macroeconomics; international trade and finance; and growth, inequality, and poverty. Real data will be used to demonstrate how current issues can be explained by economic analysis.

MBA 473 Financial Management for Executives 3 Credits
This course provides the background to optimally manage the financial well-being of corporations. Topics include: time value of money, capital-budgeting analysis, net present value, internal rate of return (IRR) and its pitfalls, real options, making cash-flow forecasts from accounting data, financial statement ratio analysis, tradeoff between risk and return, portfolio theory, and Capital Asset Pricing Model (CAPM), estimating a project's or firm's cost of capital, corporate claimants and capital structure theory, dividend policy, and elements of corporate restructuring.

MBA 474 Marketing Essentials for Executives 3 Credits
The course equips professionals with emerging and time-tested marketing management principles and techniques for the changing world shaped by technological advances, social media, and unprecedented amounts of data. From decisions on targeting to developing and communicating brands' value propositions, professionals will examine the ways in which marketing creates a lasting strategic impact. Participants will engage in a dynamic learning environment that uses the latest case studies, readings, simulations, and other learning modules to apply marketing knowledge for solving complex problems.

MBA 475 Operations and Supply Chain Management for Executives 3 Credits
The course is designed to explore how organizations develop supply chain flows from upstream supply management, to internal processes, and to distribution channels, in order to deliver goods and services that exceed customer expectations and create societal value. New business models and forms of operations enabled by technological innovations will be explored. Topics covered include operations strategy, demand/customer management, supply/capacity planning, raw material/component sourcing, inventory planning, fulfillment and distribution, sustainability, and industry 4.0.

MBA 476 Talent Management for Executives 3 Credits
This course highlights key principles of human behavior at work to address talent management issues in organizations and delves into how those principles can be ethically applied in a data analytics age, not just to attract and select the right employees for a given organization, but also to motivate, lead, empower, and develop others. Students will acquire skills and knowledge that will enhance your ability to analyze and resolve individual performance issues and organizational talent challenges with a global perspective.

MBA 481 Mastering Strategy 3 Credits
This course emphasizes strategic management from a general manager standpoint. Students apply essential business knowledge through simulation, case presentations, and the cross core project. We examine historical perspectives, contemporary theories, and practical applications to develop students' broad understanding of strategic management issues and solutions. By combining high-level class discussions, case analyses, a computer simulation competition, and the cross core project, this course exposes students to rigorous theoretical analysis while providing hands-on, simulated real-world business experiences.
Prerequisites: MBA 471 and MBA 472 and MBA 473 and MBA 474 and MBA 475 and MBA 476

MBA 482 Executive Leadership 3 Credits
This course examines leadership at the organization and team levels. It aims to develop leadership skills and the ability to diagnose leadership needs in different situations. The course focuses on the decisions leaders need to make, and the appropriate leadership decision-making processes required in various contexts and at different stages of an organization's existence. Cases and developmental exercises including in-depth decision-making exercises are utilized and cover diverse situations and cross-cultural dimensions including crisis and change management or ethically difficult decisions.
Prerequisites: MBA 471 and MBA 472 and MBA 473 and MBA 474 and MBA 475 and MBA 476

MBA 483 Digital Strategies for Organization Transformation 3 Credits
The course is designed to develop an understanding of how new business strategies can be developed and existing business strategies be improved through the introduction of technologies and digital systems. The course will highlight opportunities created by new digital technologies, artificial intelligence, and big data, identify organizational challenges and barriers to digital transformation, and present frameworks and roadmaps to developing and implementing digital transformation strategies.
Prerequisites: MBA 471 and MBA 472 and MBA 473 and MBA 474 and MBA 475 and MBA 476

MBA 484 Societal Challenges: Implications for Business 3 Credits
This course examines societal shifts (e.g., artificial intelligence, blockchain, changing demographics, and climate change) and how society needs to think about sustainable growth in the coming decades. The societal shifts will be examined in pairs and then integrated to form scenarios for society in the coming decades. The focus is on the impacts of these societal shifts at the industry and individual company level.
Prerequisites: MBA 471 and MBA 472 and MBA 473 and MBA 474 and MBA 475 and MBA 476

Law Courses

LAW 417 Regulatory Environment of Business 2 Credits
This course is designed to provide students with a basic understanding of the various legal, regulatory, and market constraints in which business operates. Students are introduced to the interplay between legislation, regulations, and court decisions in establishing the regulatory environment in which a business operates as well the allocation of power among federal and state authorities. Conflict of law issues will also be explored for businesses that operate internationally. Contract law, forms of business, and ethics are covered in depth.

Management Courses

MGT 416 Managing Talent 3 Credits
The course is fundamentally about understanding and improving the behavior and performance of individuals in the workplace. As such, we will draw upon key theories in organizational behavior to address human resource issues arising from the employment relationship. Topics will address key areas in the talent pipeline from sourcing and selection, training and development, motivation and performance management, to talent management metrics and analytics.

MGT 431 Leadership in Contemporary Organizations 1.5 Credit
Leadership skill development for increasingly complex environments. This course covers concepts that will enable students to navigate their mutual interdependence in modern, complex, organizations. It focuses on personal leadership concepts (e.g., growth mindset; emotional intelligence), as well as relational leadership concepts (e.g., listening; giving and receiving feedback; coaching; how to have difficult conversations) and/or team leadership concepts.

MGT 436 Managing People 3 Credits
This course examines how effective organizations are created, maintained, and improved. The course will focus on how good people are attracted to an organization and how to make them productive. Topics include: organizational design, job design, staffing, training and development, performance, teams, influence, diversity, change, ethical decision-making, and current people issues facing today's organizations.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

MGT 438 Strategy for Competitive Advantage 3 Credits
The focus of this course is on how the organization creates and maintains competitive advantage in a rapidly shifting, complex environment. This course will give you the critical thinking skills to evaluate the current environment, predict how that environment is likely to shift in fundamental ways in the future, and build a resilient, adaptive strategy for your organization.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

MGT 439 Applied Capstone Experience (ACE) 1.5 Credit
The Applied Capstone Experience, or ACE, challenges students to grapple with a complex issue facing their organization. It builds on the functional topics and projects from other core courses, such that the ACE integrates different functional lenses in addressing a complex problem or opportunity that is critical to the organization. Students identify this substantive challenge facing the organization, work to understand its interconnectedness with the other operations of the organization, and seek to provide implementable strategic and operational solutions.
Prerequisites: ACCT 432 and FIN 433 and BIS 434 and SCM 435 and MGT 436 and MKT 437 and MGT 438
Can be taken Concurrently: ACCT 432, FIN 433, BIS 434, SCM 435, MGT 436, MKT 437, MGT 438

MGT 461 Strategic Management 1 Credit
Strategic Management covers overall organizational issues in determination, analysis, execution, and control within a global environment. This capstone course integrates theories and concepts from production, marketing, finance, and accounting and provides an opportunity to simulate the function of top level management as it relates to the total business environment through a team-based business simulation. Through readings, written assignments, presentations, in-depth group discussions, and a team-based simulation competition, students will broaden their understanding and practice the art of strategic decision making.

MGT 462 Experiential Learning Capstone 3 Credits
The Experiential Learning Capstone in the M2 curriculum immerses students in the study of how historical, iconic companies, under the guise of strategic management principles, created disruptive/game-changing industry innovation. Built on the foundational courses in the M2 curriculum, the capstone integrates classroom lectures with a combination of company visits and externship projects. Students apply their foundational learning in the study of how birth was given to a select set of companies.

Marketing Courses

MKT 415 Marketing Foundations 3 Credits
This course is designed to provide students with a comprehensive analytical framework to develop, implement and evaluate competitive marketing strategies that achieve organizational goals and objectives. It explores the functional marketing operations of organizations and examines the key elements of a marketing manager’s decision making process. Examples of learning modules include: customer and market analysis, segmentation, targeting and positioning, marketing mix decisions (product, price, placement and promotion).

MKT 425 Contemporary Topics in Marketing 2 Credits
The objective of this course is to build on the principles learned in Marketing Foundations and study a series of contemporary topics relevant for the marketing function in organizations. The focus is on key factors that are driving changes in the marketplace and the implications to the organization when devising strategies. Students will obtain an understanding of how to identify emerging trends, explore the underlying antecedents and consequences of these trends, and learn how organizations can proactively manage these trends.
Prerequisites: MKT 415

MKT 437 Customer Insights and Marketing Strategy for Managers 3 Credits
This course presents principles, tools, and techniques to understand customers and the marketplace that enable marketers to create, communicate, and deliver superior value to all stakeholders. Select topics include segmenting and targeting prospective customers, assessing competitors, positioning offerings, managing customer relationships, and creating lifetime value. Building on the fundamentals, more advanced conceptual frameworks, analytical tools, and contemporary perspectives for managerial decision-making will be applied to effectively develop and manage new and existing customer offerings in the increasingly data-rich environment.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

Masters Accounting Courses

MACC 407 Federal Income Taxation 3 Credits
An introductory study of the principles and concepts of federal income taxation of individuals, corporations, partnerships, and fiduciaries; and federal gift and estate taxes. Determination of tax liabilities and opportunities for planning are emphasized. Problem-solving using the source materials of tax law and tax research are important components of the course. Credit will not be given for both MACC 407 and ACCT 307.
Prerequisites: MACC 415

MACC 409 Advanced Federal Income Taxation 3 Credits
An advanced study of the taxation of business organizations, estates, trust, and wealth transfer taxes. Planning and research are the basic components of the course. Problem-solving and written research are emphasized. Credit will not be given for both ACCT 309 and MACC 409.
Prerequisites: ACCT 307

MACC 411 Accounting Information Systems 3 Credits
An introduction to the concepts underlying information systems as they relate to organizational structure, managerial decision making and accounting. The course acquaints students with the reports and documents generated by information systems, as well as procedures and controls employed in a variety of business applications. Students apply these concepts, techniques and procedures to the planning, analysis and design of manual and computer-based information systems. Credit will not be given for both MACC 411 and ACCT 311.

MACC 412 IT Auditing 3 Credits
Addresses internal control and audit issues in an Information Technology (IT) environment. structured around the COSO internal control framework. Audit procedures for the review of IT general and application controls are examined. Students perform substantive tests on financial databases using audit software. Topics covered: Internal controls in centralized and distributed IT environments, IT outsourcing, IT governance, Data modeling, network and database security ACL software, SAP process and control issues.

MACC 413 The Corporate Financial Reporting Environment 3 Credits
This course addresses the nature of corporate financial reporting, its role in providing decision-useful information to capital market participants, standard-setting and the FASB conceptual framework, and theoretical and empirical assessments of its performance.

MACC 415 Intermediate Accounting I 3 Credits
Intensive study of the basic concepts and principles of financial accounting, emphasizing the problems of fair presentation of an entity's financial position, operating results and cash flows. Understanding of the conceptual framework of accounting, review of the accounting process, and recognition, measurement, valuation and disclosure of current assets, fixed assets, and intangibles. Problem-solving skills and critical analysis are stressed. Credit will not be given for both MACC 415 and ACCT 315.

MACC 416 Intermediate Accounting II 3 Credits
The sequel to MACC 415, this course continues with intensive study of recognition, measurement, valuation and disclosure issues relating to such topics as investments, liabilities, leases, pensions, income-taxes, share-based payments, revenue issues, earnings per share, and complexities related to the statement of changes in financial position. Analysis and interpretation of financial statements and problem-solving skills are integral parts of the course. Credit will not be given for both MACC 416 and ACCT 316.
Prerequisites: MACC 415

MACC 417 Advanced Financial Accounting 3 Credits
A study of specialized topics in financial accounting, including partnership accounting, business combinations and consolidated financial statements, segment and interim reporting, foreign currency transactions and translation, and accounting and reporting for governmental and other nonprofit organizations. Involves considerable problem-solving and critical evaluation of controversial theoretical issues. Credit will not be given for both MACC 417 and ACCT 317.
Prerequisites: MACC 416

MACC 419 Auditing 3 Credits
An introduction to auditing theory, objectives, and practices related largely to the responsibilities of independent professional accountants. The auditing environment, generally accepted auditing standards, internal control theory, and reporting alternatives are considered. Exposure to operational auditing is provided. Credit will not be given for both MACC 419 and ACCT 320.
Prerequisites: MACC 415 and MACC 411

MACC 420 Fraud Examination and Forensic Accounting 3 Credits
This course focuses on developing student understanding of forensic accounting and fraud investigation for introduction to the forensic accounting profession. Course provides enhanced knowledge of occupational fraud, with emphasis on financial statement fraud. Topics include the nature/theories of fraud, fraud prevention/detection techniques and the legal and auditing framework for fraud investigation. Course integrates data analytic techniques in fraud examination and detection, analysis of SEC cases involving fraud allegations and incorporates materials provided by the Association of Certified Fraud Examiners (ACFE).
Prerequisites: ACCT 320

MACC 423 Managerial Accounting 3 Credits
An in-depth study of concepts and methods involved in the collection, organization, dissemination and interpretation of information that facilitate operational and strategic decisions. Topics include: product costing; relevant costs for outsourcing and other operational decisions; metrics development; budgeting, performance evaluation; target costing; and transfer pricing. Credit will not be given for both MACC 423 and ACCT 324.

MACC 424 Governance, Risk and Control 3 Credits
This course focuses on developing in students an understanding of corporate governance, risk oversight and internal control monitoring from an accounting professional's perspective. Topics include agency theory, fundamentals of corporate governance, risk and internal control, functions of the board of directors and the audit committee, independent auditor and impediments to audit quality, internal auditor's role, and SEC regulations and laws impacting governance, risk and control. Class discussions, interactive group exercises, role plays, field projects, and real-life cases are used.
Prerequisites: ACCT 320 or BUA2

MACC 427 Accounting Research and Regulation 3 Credits
Explores the mechanics of performing professional accounting research through analysis of the authoritative accounting literature applied to emerging accounting issues. While emphasizing U.S. GAAP and the Accounting Standards Codification, students will also work with SEC reporting requirements, PCAOB and AICPA auditing standards, and International Financial Reporting Standards. Students will develop skills to conduct research, determine the appropriate accounting for new and complex business transactions, and document the rationale for the accounting method chosen.
Prerequisites: ACCT 316 or MACC 416

MACC 430 Data Analytics for Accountants 3 Credits
This course uses publicly available financial statement information to programmatically analyze company activities. Obtaining, cleaning, exploring, analyzing with statistical and machine learning methods, and presenting accounting data are explored in a project based format. Non-financial related information analyses are linked to audit and risk assessments. Projects and papers involve actual entities and associated financial information. Credit will not be given for both MACC 430, Data Analytics for Accountants and ACCT 330, Accounting Data and Analytics.
Prerequisites: ECO 045

MACC 490 Business Skills for Accounting Professionals 3 Credits
Enhances key skills necessary to function effectively in a professional accounting environment. Topics include oral and written communication, exercising professional judgment, protecting and upholding professional integrity, developing and maintaining professional relationships, analyzing data to inform business decisions. Weekly participation in the Segal Accounting Distinguished Speaker Series is an integral part of this course.

MACC 491 Internship in Accounting 3 Credits
Supervised internship experience in auditing, tax consulting, corporate accounting of at least eight weeks duration.
Prerequisites: MACC 419

Project Management Courses

PMGT 409 Project Management Fundamentals 3 Credits
Introduction to project management – survey of the knowledge areas and approaches to managing projects. Looks at the relationship of projects to organizational strategy and culture, how to initiate a project, principles of planning and project execution and control, managing stakeholders, and communicating effectively. A review of the competencies required to address the complexities and challenges of projects. Hands-on approach to developing project management work artifacts and simulated project management game are used.

PMGT 410 Project Requirements and Scope Management 1 Credit
Focuses on understanding the principles and nuances of managing project and product scope: the boundaries of inclusion and exclusion of the product – its features and functions, and of the project – the work involved to create the project's product. Addresses the methods for eliciting and managing product and project requirements, defining the project scope, creating a scope baseline, and managing changes to control scope creep.
Prerequisites: PMGT 409
Can be taken Concurrently: PMGT 409

PMGT 411 Project Scheduling, Estimating & Budgeting 1 Credit
This course explores the methods and challenges of developing project estimates, schedules, and budgets. Expectations about project timelines and costs cause a great deal of friction and frustration in projects. In this course students will learn how to build a schedule using the critical path method, methods for resource loading, developing contingency reserves, and time and cost estimates. They will also learn how to present schedule information to manage expectations and deal with slips when they occur.
Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 412 Advanced Scheduling & Scheduling Tools 1 Credit
This course deals with developing a schedule in MS Project in a hands-on class. Students will learn to build a fully resource loaded, networked, and baselined schedule in MS Project, and how to manage from that schedule. Students will also explore the principles of critical chain scheduling, dealing with risks in schedules, and using the schedule to forecast outcomes and communicate effectively with stakeholders about time expectations.
Prerequisites: PMGT 409 and PMGT 410 and PMGT 411

PMGT 413 Project Risk Management 1 Credit
As projects always involve a new and unique endeavor to the performing organization, uncertainty is a part of every project. Effective project management prepares for the risks - both jeopardies and opportunities - presented by these uncertainties. In this class we will explore both the classic and some more advanced methods for dealing with project risks.
Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 414 Managing Project Quality 1 Credit
Students will explore the key concepts of quality management and how they apply in projects. This class discusses the use of the quality management tools and methods, practices for holding quality reviews, and for developing project quality management plans.
Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 415 Project Procurement & Negotiation 1 Credit
This class focuses on the tools and practices used in managing procurement on projects, and best practices for negotiation and supplier management. It explores the role of the contract, types of contracts, developing the statement of work, RFP, screening & selection criteria, and the procurement management plan. It also looks at how to manage contractors throughout the project.
Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 416 Decision Making and Ethics on Projects 1 Credit
This class examines the factors and processes for making effective and ethical project decisions. The unknowns, complexities, time and cost pressures, and cross-functional stakeholders make good decision-making imperative for long-term and short-term success. Students will use a variety of tools and techniques for team decision-making. The class includes a case study to explore decision-making and ethical issues.

PMGT 417 Project Leadership 1 Credit
Good management skills alone will not create project success. Leadership, which is much more elusive, is equally if not more important. This class will explore models of leadership and how they apply to projects, styles of leadership, motivation, influence, politics, and dealing with difficult stakeholders.

PMGT 418 Facilitation and Teamwork for Projects 1 Credit
This class focuses on the principles and practices of teamwork, an essential element for projects. Students will examine the effectiveness of different types of team structures and maturity levels for teams and organizations. They will learn methods for dealing with conflict, facilitating groups, and the different types of meetings used in projects. This class will use case studies as well as hands-on methods.

PMGT 419 Adaptive and Agile Project Management 1 Credit
In this class we will explore the new methods used for more extreme projects – those with more complexity, market acceptance, time pressure, and advanced technology. Students will examine the factors affecting complex projects with cross-functional and dispersed teams as well as principles for Agile project approaches. This class will use case studies as well as hands-on methods.
Prerequisites: PMGT 409 and PMGT 410

PMGT 420 Managing Projects for Innovation 1 Credit
Traditional project management tries to instill discipline in a seemingly chaotic process, but for innovation to thrive we must couple discipline with creativity. In this class students will explore the paradoxes innovations create, and look at ways to remove blocks and spark imagination while producing value for the organization. Case studies and hands-on techniques will be utilized in this course.
Prerequisites: PMGT 409 and PMGT 410

PMGT 421 Project Management Capstone 1-3 Credits
This class is conducted as an independent study and involves applying the principles and practices of the previous project management classes to a real-life project or approved case study. You will develop a set of project documents and provide a critical analysis of the project to demonstrate your mastery of the project management skills prescribed for a predictive (plan-based) project.
Prerequisites: PMGT 409 and PMGT 410 and PMGT 411 and PMGT 413 and PMGT 416

Supply Chain Management Courses

SCM 423 Supply Chain Operations Management 2 Credits
This course provides an essential understanding of managing global supply chains and operations within the context of an integrated value chain. Topics addressed include the fundamentals of supply chain management; supply chain risk management; quality management; demand and supply chain planning, including forecasting, capacity planning, aggregate planning, and scheduling; the components of a lean supply chain; inventory and working capital management; distribution and transportation management; and performance measurement. Special emphasis is given to managing supply chains from a financial perspective.

SCM 435 Operations and Supply Chain Management 3 Credits
This course provides students with an overview of supply chains, operations of organizations within the supply chain and the impact of their designs on organizational competitive strategies. It provides basic techniques organizations use when operating within modern supply chains and reviews key decision tools such as demand planning, capacity management and processes improvement.
Prerequisites: (ECO 045 or BUEC) and MGT 431
Can be taken Concurrently: MGT 431

Business Information Systems

The BIS major, housed in the Department of Decision and Technology Analytics (DATA), provides students with a strong foundation in cross-functional business processes and the application of information systems to support them. The use of technology and data analytics to improve business performance and effectively support strategic business plans is a major focus of the program. Career opportunities for BIS majors include: business analyst, data analyst, systems analyst, and information systems consultant.

The Business Information Systems major requires three (3) courses and three (3) electives beyond the core requirements of the College of Business. Students are required to take BIS 44, Business Analytics I; BIS 244, Business Analytics II; and BIS 111, Introduction to Information Systems, as part of the business and economics core. Other courses are as follows:

Required Courses		
BIS 311	Managing Information Systems Analysis and Design	3
BIS 324	Business Data Management	3
BIS 335	Application Development for Business	3
Elective Courses		
Select three of the following:		9
BIS 333	Enterprise Security and Risk Management	
BIS 342	e-Business Enterprise Applications	
or SCM 342	e-Business Enterprise Applications	
BIS 344	Cloud Computing for Business	
BIS 372	Special Topics in Information Systems [1]	

ACCT 311	Accounting Information Systems	
ENTP 304	Technology and Software Ventures	
Total Credits		**18**

1

Courses focusing on different applications of IS in business, including: Data Warehousing and Mining, HR Applications in IS, Numerical Methods of Business Decisions, etc. Consult Professor David Zhang for other related courses.

Business Information Systems Minor

This minor provides an overview of the major technical functions in IS, such as design of systems and the development and management of databases. In addition, the student explores the applications of IS to business problems in one of several electives. This minor is available only to students with a declared major in the College of Business.

This minor provides an overview of the major technical functions in IS, such as design of systems and the development and management of databases. In addition, the student explores the applications of IS to business problems in one of several electives. This minor is available only to students with a declared major in the College of Business degree program or a declared major in the Integrated Business and Engineering (IBE) program (except for IBE students with the CSE major). The minor is not available to students outside of those two degree programs. The minor is not available to students in the CSB program, and the minor is not available to students in the IBE program who major in CSE.

Students must complete all courses for the minor with a grade point average of 2.0 or higher. The Business Information Systems minor consists of the following:

Required Courses (2):

BIS 311	Managing Information Systems Analysis and Design	3
BIS 324	Business Data Management	3
Select one of the following courses:		3
BIS 333	Enterprise Security and Risk Management	
BIS 335	Application Development for Business	
BIS 342	e-Business Enterprise Applications	
BIS 344	Cloud Computing for Business	
Total Credits		**9**

Courses

BIS 044 (BUAN 044) Business Analytics I 1.5 Credit
This course covers the basic concepts of data, including the collection, organization, exploration, and understanding of data with an emphasis on complex business data. The focus is on data as an organizational asset, and how data is structured for use in business to optimize business decisions and processes. Students will implement data analytic techniques through hands on programming.

BIS 111 Introduction to Information Systems 3 Credits
This course examines the fundamental role of information systems in supporting and managing all business functions and enabling firms to compete effectively. Both technical and managerial aspects of information systems are introduced. The course integrates technical infrastructure, database concepts, management decision-making, and business process issues critical to the understanding of operational and strategic information systems. It introduces business applications that support accounting, finance, supply chain management, and marketing.

BIS 244 (BUAN 244) Business Analytics II 1.5 Credit
This course covers techniques and algorithms for creating effective visualizations of complex business data. The emphasis will be on the use of data visualization in business decision making. Students will implement data analysis and visualization through hands on programming and visualization tools.
Prerequisites: BIS 044 and (ECO 045 or MATH 231 or ISE 121)

BIS 300 Apprentice Teaching 1-4 Credits

BIS 311 Managing Information Systems Analysis and Design 3 Credits
This course focuses on managing the requirements analysis and system design methodology and techniques for business information systems. Students learn current methods and techniques for system requirement analysis as well as system design, and apply them to real world projects. It covers cost benefit analysis and risk management of business systems development, JAD and structured walkthroughs, structured and object oriented methodologies, and software package evaluation. It emphasizes the factors for effective communication and integration with users and user systems and encourages interpersonal skill development with client users, team members, and others associated with development, operation, and maintenance of the system.
Prerequisites: ACCT 311 or CSB 311 or BIS 111

BIS 324 Business Data Management 3 Credits
This course covers the fundamentals of database management systems (DBMS), including database development, processing, logical and physical design, access, implementation and administration. Students will gain extensive experience in developing data models, creating relational databases, and formulating and executing complex queries. The focus in the course will be on analyzing the connections between data and business organizational information needs and decisions, and understanding the principles of managing organizational data. A project with hands-on experience with a large scale DB is included.
Prerequisites: BIS 111

BIS 333 Enterprise Security and Risk Management 3 Credits
This course explores the management of enterprise IT solutions. The focus is on the management of applications and infrastructure security. Students will be introduced to frameworks for infrastructure management, system administration, critical security principles that enable them to plan, develop, and perform security tasks. The course will address hardware, software, processes, communications, applications, and policies and procedures with respect to enterprise IT Security and Risk Management. These topics are addressed both within and beyond the organization, with attention paid to managing risk and security within audit and compliance standards.
Prerequisites: BIS 111

BIS 334 Business Data Networks and Security 3 Credits
This course provides an overview of wired and wireless networking standards, switching and routing functionality, network administration, firewalls, and virtual private networks. Throughout the course, a heavy emphasis is placed on ensuring the confidentiality, integrity, and availability of secure networked communications.
Prerequisites: BIS 111 or CSE 003 or CSE 004 or CSE 007 or CSE 012 or CSE 017

BIS 335 Application Development for Business 3 Credits
This course provides an introduction to planning, designing, developing and maintenance of high quality computer applications that solve business problems. Students will learn basic systems development and computer programming concepts by designing, coding, and testing in an object oriented computer language. Emphasis will be placed on learning introductory programming concepts, such as declaring variables, control statements, subroutines, functions, and arrays. Additionally, students will develop event-driven graphical user interfaces. Some previous experience with programming helpful but not required.
Prerequisites: BIS 111

BIS 342 (SCM 342) e-Business Enterprise Applications 3 Credits
Introduction to the implications of key information technologies used within and across businesses to conduct e-business. The course covers the functionality of various enterprise applications and their integration: customer relationship management, enterprise resource planning, supply chain management, supplier relationship management, data warehousing and mining, business intelligence, and product lifecycle management.
Prerequisites: BIS 111

BIS 344 Cloud Computing for Business 3 Credits
This course focuses on understanding risk assessment, security guidance, design and deployment of cloud services solutions. Students will demonstrate an understanding of high availability and business continuity, cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. The applied portion of the course gives students hands-on experience designing and deploying cloud environments and services on platforms such as Amazon Web Services.
Prerequisites: BIS 111

BIS 350 (MGT 350) Project Management 3 Credits
Key processes and tenets of project management including scope, time, cost, quality, human resources, communications, risk, procurement, and integration management. Both technical and behavioral aspects of project management are applied within the context of either IS management, HR management, Supply Chain Process Management, Small Business Management. Topics include: expectations management, change management and consulting engagement management. Introduces both software project monitoring tools and project team collaboration techniques and tools. Must have completion of all other courses in either BIS or Management major.
Prerequisites: BIS 335 and BIS 324

BIS 360 Business Information Systems Practicum 3 Credits
The business information systems practicum provides an opportunity for students to work on an intensive consulting engagement with a business. Students work with client firms on individual or team projects, which focus on information systems activities such as developing requirements, designing, and implementing systems. Students complete written reports and make formal presentations to clients. May not be taken concurrently with MGT 311. Cannot be used to satisfy BIS major or minor requirements.

BIS 371 Directed Readings 1-3 Credits
Readings and research information systems; designed for superior students who have special interest in some topic(s) not covered by the regularly scheduled courses. Written term paper(s) required. Must have preparation in information systems acceptable to program coordinator.
Repeat Status: Course may be repeated.

BIS 372 Special Topics in Information Systems 1-3 Credits
Special problems and issues in information systems for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of the instructor and students. Must have preparation in information systems acceptable to program coordinator.
Repeat Status: Course may be repeated.

BIS 373 Business Information Systems Internship 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments-including a "capstone report." It should be noted that the work experience (at least 80 hours per credit), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements, including designating a sponsoring faculty member, must be made in advance of the work engagement. This course must be taken Pass/Fail,.
Repeat Status: Course may be repeated.
Prerequisites: BIS 311

BIS 396 1-3 Credits
Repeat Status: Course may be repeated.

BIS 411 Storytelling in Business Analytics 1.5 Credit
Focuses on training students to visualize business data and communicate implications from business data through visualization and storytelling. Covers techniques and algorithms for creating effective visualizations of complex business data. Students will implement data analysis and visualization through hands-on programming and visualization tools. Enhances students' business communications related to data. Students will translate data and analysis into narratives that provide context for their messages and make persuasive recommendations in written and oral formats.

BIS 412 Data Ethics and Security in Business 1.5 Credit
Focuses on the management of data security, the frameworks of business data ethics, and the integration of data ethics with data security management. Students will be introduced to critical security principles that enable them to plan, develop, and perform data security tasks. Addresses business ethics as it relates to a variety of data management issues.

BIS 415 Capstone Project 3 Credits
The capstone project course immerses students in projects on how business analytics skills can be applied ethically in an organization to create business value. Built on the foundational courses in business analytics, the capstone integrates classroom lectures with a combination of company visits and externship projects.

BIS 423 Management Information Systems 2 Credits
This course examines the role of information systems (IS) and information technology (IT) in the organization. The focus of the course is the organizational uses of IS and IT to compete effectively. Both technical and managerial aspects of information systems are explored. The course includes technical infrastructure, management decision-making, trends and innovations in IS, and business process issues critical to the understanding of operational and strategic information systems.

BIS 434 Decision Analytics for Managers 3 Credits
This course focuses on the key concepts and methods that relate to information management and business decision making, and how managers can create value and make better business decisions by turning information into competitive advantage. It also introduces fundamental concepts and analytic methods in business analytics. In addition, this course provides an overview of how modern information systems support business decision making as well as technology-enabled business models.
Prerequisites: (ECO 045 or BUEC) and MGT 431
Can be taken Concurrently: MGT 431

BIS 456 Business Analytics for Decision Making 3 Credits
Provides students with a theoretical and practical understanding of core data analytics concepts and techniques, and develops hands-on experience in applying these techniques to practical real-word business problems using R software. As an applied course, the emphasis will be less on the inner working of each method and more on when and how to use each technique and how to interpret the results. Not available to students who have credit for BIS 348, 448, 352 or 452.
Prerequisites: MBA 440 or ECO 045 or ECO 427 or BUEC

BIS 458 Data Management for Managers 3 Credits
Covers fundamentals of database management, including database development, processing, logical and physical design, access, implementation and administration, and design and deployment of cloud services solutions. Students will gain extensive experience in developing data models, creating relational databases, formulating and executing complex queries, and understanding cloud services solutions in cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. Hands-on experiences such as such as Oracle Database and Amazon Web Services are included.

Economics

Department of Economics web page: https://business.lehigh.edu/departments/economics (https://business.lehigh.edu/departments/economics/)

Though economics is variously defined, modern-day definitions generally suggest that it is the study of the principles that govern the efficient allocation of resources. One of the greatest of the 19th century economists who did much to uncover these principles suggested a broader definition. Alfred Marshall described economics as “a study of mankind in the ordinary business of life and a part of the study of man.”

This dual nature of economics, both technical and humanistic, is reflected in the fact that at Lehigh the Economics Major is available to students in the College of Business and the College of Arts and Sciences.

Undergraduate Programs in Economics are available in both the College of Business and the College of Arts & Sciences. Please see below.

COLLEGE OF BUSINESS

Major in Economics

Students in the College of Business electing to major in economics must take the college core courses listed in the College of Business section of this catalog. The College of Business core requires that students take ECO 001, ECO 045 and either ECO 119 or ECO 146. Majors in economics must take both ECO 119 and ECO 146, as well as ECO 157 and at least 12 credits of elective economics courses for a total of 18 credits beyond the core requirements. The Economics Major provides students with a solid grounding in the basic tools and models used in economic analysis. Combined with the College of Business core, it prepares students for careers in business, consulting, non-profit organizations, or government. The requirements beyond the College of Business core are:

Common Economics Core		
ECO 119	Intermediate Macroeconomic Analysis	3
or ECO 146	Intermediate Microeconomic Analysis	
Quantitative Economics Core		
ECO 157	Statistical Methods II	3
Students must take 12 credits from the following electives. There must be at least one course from each list, and at least two of the four courses must be at the 300 level.		
Electives - Field Courses		
ECO 209	Comparative Economic Systems	3
ECO 229	Economics of Money and Banking	3
ECO 303	Economic Development	3
ECO 304	Economic Growth	3
ECO 311	Environmental Economics	3
ECO 312	Mathematical Economics	3
ECO 322	Competitor and Market Analysis	3
ECO 338	International Economics	3
ECO 339	International Trade	3
ECO 352	Behavioral Economics	3
ECO 353	Public Economics	3
ECO 358	Game Theory	3
ECO 363	Labor Economics	3
ECO 365	Business, Government, and Macroeconomic Policy	3
ECO 368	Health Economics	3
Electives - Applying Economics		
ECO 201	Federal Reserve Challenge Competition [1]	1-3
ECO 203	Inclusive Finance and Economic Development	3
ECO 234	The Economics of Gender and Race	3
ECO 259	Project Evaluation Practicum [2]	3
ECO 273	Community Consulting Practicum [2]	3
ECO 274	Supervised Research [1, 2]	1-3
ECO 301	Econometric Software	3
ECO 314	Energy Economics	3
ECO 324	The Economics of the Sports Industry	3
ECO 325	Consumer Insights through Data Analysis	3
ECO 328	Electricity Economics	3
ECO 333	The Economics of Business Decisions	3
ECO 335	Cost-Benefit Analysis	3
ECO 336	Antitrust, Regulation, and the New Economy	3
ECO 342	The Chinese Economy - A Comprehensive Study	3
ECO 345	Political Economy of Iraq	3
ECO 357	Econometrics	3
ECO 360	Time Series Analysis	3
ECO 362	Martindale Research Seminar [1]	1-3
ECO 366	Quantitative Market Analysis	3
ECO 367	Applied Microeconometrics	3
ECO 371	Special Topics in Economics [1]	1-3
ECO 389	Honors Project [1]	1-6
Total Credits		**18**

1

Students can apply, at most, 3 credits earned in this course toward the elective requirement.

2

Only one of the following courses may be used to satisfy the elective requirement: ECO 259, ECO 273, and ECO 274.

COLLEGE OF ARTS AND SCIENCES

B.A. Major in Economics

The B.A. in Economics provides students with a solid grounding in the basic tools and models used in economic analysis. It is meant for students interested in consulting careers, careers in business or public policy, or in pursuing advanced degrees such as law. The requirements are:

Common Economics Core		**10**
ECO 001	Principles of Economics	4
ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
Quantitative Economics Core		**6**
ECO 045	Statistical Methods	3
or MATH 231	Probability and Statistics	
ECO 157	Statistical Methods II	3
Collateral Requirement		**4**
Select one of the following:		
MATH 021	Calculus I	4
or MATH 051	Survey of Calculus I	
or MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	
or MATH 081	Calculus with Business Applications I	
Electives - Field Courses		**9**
Students must take three courses from the following list, at least two at the 300 level:		
ECO 209	Comparative Economic Systems	3
ECO 229	Economics of Money and Banking	3
ECO 303	Economic Development	3
ECO 304	Economic Growth	3
ECO 311	Environmental Economics	3
ECO 312	Mathematical Economics	3
ECO 322	Competitor and Market Analysis	3
ECO 338	International Economics	3
ECO 339	International Trade	3
ECO 352	Behavioral Economics	3
ECO 353	Public Economics	3
ECO 358	Game Theory	3
ECO 363	Labor Economics	3
ECO 365	Business, Government, and Macroeconomic Policy	3
ECO 368	Health Economics	3
Electives - Applying Economics		**6**
Students must take two courses from the following list, at least one at the 300 level, earning at least 6 credits overall:		

ECO 201	Federal Reserve Challenge Competition [1]	1-3
ECO 203	Inclusive Finance and Economic Development	3
ECO 234	The Economics of Gender and Race	3
ECO 259	Project Evaluation Practicum	3
ECO 273	Community Consulting Practicum	3
ECO 274	Supervised Research [1]	1-3
ECO 301	Econometric Software	3
ECO 314	Energy Economics	3
ECO 324	The Economics of the Sports Industry	3
ECO 325	Consumer Insights through Data Analysis	3
ECO 328	Electricity Economics	3
ECO 333	The Economics of Business Decisions	3
ECO 335	Cost-Benefit Analysis	3
ECO 336	Antitrust, Regulation, and the New Economy	3
ECO 342	The Chinese Economy - A Comprehensive Study	3
ECO 345	Political Economy of Iraq	3
ECO 357	Econometrics	3
ECO 360	Time Series Analysis	3
ECO 362	Martindale Research Seminar [1]	1-3
ECO 366	Quantitative Market Analysis	3
ECO 367	Applied Microeconometrics	3
ECO 369	Analysis of Health Care Markets	3
ECO 371	Special Topics in Economics [1]	1-3
ECO 389	Honors Project [1]	1-6
Electives - Breadth Requirement		**3-4**
Students must take one course from an approved list, earning at least 3 credits. Students should select a class that helps prepare them for some potential area of further study. [2, 3]		
Total Credits		**38-39**

1

Students can apply at most 3 credits earned in this course toward the elective requirement.

2

Potential areas of further study include, but are not limited to, law or some other non-quantitative graduate degree, business, government, or the non-profit sector. **Students are responsible for making sure they have fulfilled any course prerequisites.**

3

The approved list includes the following courses: ACCT 108, ACCT 151, CSE 001 & CSE 003 (total of 4 credits), CSE 012 & CSE 003 (total of 4 credits), CSE 003 & CSE 004 (total of 4 credits), CSE 007, ENTP 101, ENTP 304, ENTP/POLS 310, ENTP 315, ES 107, FIN 125, IR 225/POLS 225, IR 222, IR 223, IR 226, LAW 101, MGT 314/ ENTP 314, PHIL 172, POLS 103, POLS 109, POLS 306, and TE 211. Please see your Economics Advisor regarding the possible approval of alternate courses which will fulfill this requirement.

COLLEGE OF ARTS AND SCIENCES

B.S. MAJOR IN ECONOMICS

The B.S. in Economics is for students who desire a more robust and technical degree program. Students will take math, computer science, and econometrics, as well as more economics, to better prepare them for technical careers or for graduate work in economics. The requirements are:

Common Economics Core		**10**
ECO 001	Principles of Economics	4
ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
Quantitative Economics Core		**9**
ECO 045	Statistical Methods	3
or MATH 231	Probability and Statistics	
ECO 157	Statistical Methods II	3
ECO 357	Econometrics	3
Collateral Requirement		**15-16**
MATH 021	Calculus I	4
or MATH 075 & MATH 076	Calculus I, Part A and Calculus I, Part B	
MATH 022	Calculus II	4
or MATH 082	Calculus with Business and Economics Applications II	
MATH 043	Survey of Linear Algebra	3
or MATH 205	Linear Methods	
or MATH 242	Linear Algebra	
Select 4 credits worth of approved CSE courses [3]		4-5
Electives - Field Courses		**12**
Students must take four courses from the following list, at most one at the 200-level:		
ECO 209	Comparative Economic Systems	3
ECO 229	Economics of Money and Banking	3
ECO 303	Economic Development	3
ECO 304	Economic Growth	3
ECO 311	Environmental Economics	3
ECO 312	Mathematical Economics	3
ECO 322	Competitor and Market Analysis	3
ECO 338	International Economics	3
ECO 339	International Trade	3
ECO 352	Behavioral Economics	3
ECO 353	Public Economics	3
ECO 358	Game Theory	3
ECO 363	Labor Economics	3
ECO 365	Business, Government, and Macroeconomic Policy	3
ECO 368	Health Economics	3
Electives - Applying Economics		**12**
Students must earn 12 credits by taking at least four courses from the following list, at most two at the 200-level: [2]		
ECO 201	Federal Reserve Challenge Competition [1]	1-3
ECO 203	Inclusive Finance and Economic Development	3
ECO 234	The Economics of Gender and Race	3
ECO 259	Project Evaluation Practicum	3
ECO 273	Community Consulting Practicum	3
ECO 274	Supervised Research [1]	1-3
ECO 314	Energy Economics	3
ECO 301	Econometric Software	3
ECO 324	The Economics of the Sports Industry	3
ECO 325	Consumer Insights through Data Analysis	3
ECO 328	Electricity Economics	3
ECO 333	The Economics of Business Decisions	3
ECO 335	Cost-Benefit Analysis	3
ECO 336	Antitrust, Regulation, and the New Economy	3
ECO 342	The Chinese Economy - A Comprehensive Study	3
ECO 345	Political Economy of Iraq	3
ECO 360	Time Series Analysis	3
ECO 362	Martindale Research Seminar [1]	1-3

ECO 366	Quantitative Market Analysis	3
ECO 367	Applied Microeconometrics	3
ECO 369	Analysis of Health Care Markets	3
ECO 371	Special Topics in Economics [1]	1-3
ECO 389	Honors Project [1]	1-6
Total Credits		**58-59**

1

Students can apply, at most, 3 credits earned in this course toward the elective requirement.

2

Students may substitute one class from outside the Economics Department with approval of their advisor. Substitute classes must be at least at the 200-level.

3

Students can choose from the following combinations of courses: (CSE 001 and CSE 003) or (CSE 012 and CSE 003) or (CSE 003 and CSE 004)* or CSE 007*.
*We highly recommend the last two options as CSE 001 will be offered infrequently.

COLLEGE OF ARTS AND SCIENCES

JOINT INTERNATIONAL RELATIONS and ECONOMICS MAJOR

IR-Eco Major **(**p. 188**)** **(60-61 credits)**

This major combines international economics, which is the study of markets and economic policy, with international political economy, which studies international institutions and the interactions of states with those institutions and with each other, motivated by trade-offs among economic goals and considerations of power, national security, and citizen welfare. Study of economic theory, as well as institutional arrangements, allows students to understand political and distributional consequences for the world economy.

HONORS IN ECONOMICS

Economics majors from both the College of Business and the College of Arts and Sciences (CAS) who wish to be considered for departmental honors must consult with their major mentor or advisor and request such consideration by the end of their junior year. To be eligible for departmental honors, a student must have: **a cumulative GPA of 3.5 or better, completed at least three 200-level or 300-level economics courses before beginning the thesis work, and found a faculty member willing to advise the work and another willing to serve as the second reader.** To begin, the student must submit a well-thought-out and well-written thesis proposal to the mentor or advisor. To graduate with honors, the student must submit a written thesis and make an oral presentation of the work. Students fulfilling all requirements of the honors program will receive credit for ECO 389; these credits may be applied toward the elective requirements of the Economics Major. Interested students should contact the Director of the Economics Honors Program (please contact the Department Coordinator for the Director's contact information).

MINOR IN ECONOMICS

This minor is available to all students in the College of Arts and Sciences (CAS), the Rossin College of Engineering and Applied Science (RCEAS), the College of Health, and intercollegiate programs [such as Integrated Business and Engineering (IBE) and Computer Science and Business (CSB)]. Interested students should contact the Minor Advisor (please contact the Department Coordinator for the Minor Advisor's contact information).

A minor in economics consists of 12 credit hours beyond ECO 001. Required courses in the minor are:

ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
Two elective courses [1]		6

1

Electives must be chosen from among 200-level and 300-level economics offerings, with at least one course being a 300-level elective. None of the following courses -- ECO 201, ECO 259, ECO 273, ECO 274, ECO 301, ECO 362, ECO 371, ECO 389 -- may be used to satisfy the requirement.

Courses

ECO 001 Principles of Economics 0,4 Credits
A one-semester course in the principles of economics. General topics covered are: supply and demand; pricing and production decisions of firms; the role of government in the economy; the determination of national income; money and banking; monetary and fiscal policy; and government finance.
Attribute/Distribution: SS

ECO 045 Statistical Methods 3 Credits
Descriptive statistics, probability and probability distributions, sampling, estimation, hypothesis testing, chi-square tests, simple regression and correlation. Note: College of Business students may not take MATH 012 as a replacement for ECO 045.
Attribute/Distribution: Q

ECO 119 Intermediate Macroeconomic Analysis 3 Credits
Macroeconomic measurement, theory and policy. The use of alternative macroeconomic models to analyze the level of national income, inflation, unemployment, economic growth; the balance of payments, and exchange rate determination.
Prerequisites: ECO 001 and (MATH 021 or MATH 031 or MATH 051 or (MATH 075 and MATH 076) or MATH 081)
Attribute/Distribution: Q, SS

ECO 146 Intermediate Microeconomic Analysis 3 Credits
The application of economic analysis to managerial and public policy decision-making.
Prerequisites: (ECO 001) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or (MATH 075 and MATH 076),)
Attribute/Distribution: Q, SS

ECO 157 Statistical Methods II 3 Credits
The course is a continuation of Economics 045 that gives broader coverage of linear regression and the construction of empirical models. Topics include the analysis of variance, simple and multiple regression, time series analysis, and forecasting.
Prerequisites: MATH 012 or MATH 231 or ECO 045 or BSTA 001
Attribute/Distribution: Q

ECO 173 Economics Internship 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a "capstone report." It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail, cannot be used to satisfy economics major requirements. Declaration of an economics major and consent of department required.
Prerequisites: ECO 001

ECO 201 Federal Reserve Challenge Competition 1-3 Credits
To prepare for the Federal Reserve Challenge Competition. Course may be repeated for credit. Credits are assigned based on role - 1 credit for 1st time researchers, 2 credits for 2nd time researchers, and 3 credits for speakers. Up to three credits of the course can be counted toward the economics major, but the course cannot count toward the economics minor. Department permission is required for enrollment.
Repeat Status: Course may be repeated.
Prerequisites: ECO 119
Can be taken Concurrently: ECO 119
Attribute/Distribution: Q, SS

ECO 203 Inclusive Finance and Economic Development 3 Credits
Non-technical survey of the global inclusive finance sector, which provides financial services to the poor at large scale, mostly in developing nations. Historical origins and industry evolution. Nature and developmental role of microenterprises and informal finance. Methods and technologies used by microfinance institutions and other inclusive finance providers. Case studies. The lives of clients. Policy and regulatory environments. Debates over profiting from the poor, and over health and environmental goals. Conflicting evidence on economic and social impact. Meetings with practitioners.
Prerequisites: ECO 001
Attribute/Distribution: CC, SS, SW

ECO 209 Comparative Economic Systems 3 Credits
An analysis of the microeconomic and macroeconomic, institutional, and political dimensions of various economic systems, with particular emphasis on centrally planned economies in their transition to a market orientation.
Prerequisites: ECO 001
Attribute/Distribution: SS

ECO 229 Economics of Money and Banking 3 Credits
This course studies the economics of money, banking, interest rates, and monetary policy as they apply to the U.S. and other economies. This course has two main objectives. One is to study the main aspects of banks through their role in financial intermediation and the effects on monetary policy. The second objective is to study the role of money, central banking, and the conduct of monetary policy.
Prerequisites: ECO 001 and ECO 119
Can be taken Concurrently: ECO 119
Attribute/Distribution: Q, SS

ECO 234 The Economics of Gender and Race 3 Credits
In this course, students will explore, through mass media and documentaries, current socioeconomic issues and policies concerning race and gender in the United States and around the globe. Students will employ economic theory at the introductory level and will explore and analyze empirical evidence to complement the theories.
Prerequisites: ECO 001
Attribute/Distribution: CC, SS, SW

ECO 259 Project Evaluation Practicum 3 Credits
Students participate as members in cross-discipline, team-based Integrated Learning Experience (ILE) research projects. The twin purposes of the course are to provide real-world, team-oriented experiential learning opportunities and to apply economic analysis in evaluating the costs and benefits of newly proposed, or renovations and expansions to existing, university facilities and programs.
Prerequisites: ECO 146

ECO 273 Community Consulting Practicum 3 Credits
This course involves teams of students in community-oriented research projects. The twin purposes of the course are to provide real-world, team-oriented learning experiences and to provide a resource for local governments and community organizations that would allow them to draw upon the expertise of our students as consultants in analyzing problems and formulating policy.
Prerequisites: ECO 001
Attribute/Distribution: Q

ECO 274 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty supervision. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.
Prerequisites: ECO 119 or ECO 146 or ECO 157
Attribute/Distribution: Q

ECO 300 Apprentice Teaching 1-3 Credits

ECO 301 Econometric Software 3 Credits
The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Students will develop data management and programming skills using the Stata or SAS system. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course, students will be able to manage data to boost their research and analysis skills.
Attribute/Distribution: Q

ECO 303 Economic Development 3 Credits
Economic development, economic growth and their political environment are discussed in detail. The principal economic development theories are examined. These theories are used to examine a variety of development issues including planning, poverty, rural-urban relationships, physical and human capital accumulation, international trade, and the environment. Emphasis on institutions and development policy.
Prerequisites: ECO 119 or ECO 146
Attribute/Distribution: CC, SS, W

ECO 304 Economic Growth 3 Credits
A theoretical and empirical examination of economic growth and income differences between countries. The course focuses on both the historical experience of countries that are currently rich and the process of catch-up among poorer countries. Topics include population growth, the accumulation of physical and human capital, technological change, natural resources, income distribution, geography, government and culture. The course will involve extensive mathematical, analytical, verbal, and communication skills, those typical of any rigorous upper-level undergraduate economics course.
Prerequisites: ECO 119
Attribute/Distribution: CC, SS, W

ECO 311 Environmental Economics 3 Credits
Resource allocation implications of environmental degradation. Analysis of the benefits and costs associated with alternative pollution control programs and strategies.
Prerequisites: ECO 146
Attribute/Distribution: CC, Q, SS

ECO 312 Mathematical Economics 3 Credits
Applications of various mathematical techniques in the formation and development of economic concepts and theories. Students cannot receive credit for both ECO 312 and ECO 412.
Prerequisites: ECO 146 and MATH 022
Attribute/Distribution: Q

ECO 314 Energy Economics 3 Credits
The economic theory of natural resource allocation over time. Economics of exhaustible and renewable resources. Environmental effects of energy production and consumption. Government regulation of the energy industry. Computer models for energy system forecasting and planning.
Prerequisites: ECO 146
Attribute/Distribution: CC, Q, SS

ECO 322 Competitor and Market Analysis 3 Credits
Firms that compete with only a few other firms in a market must behave strategically. In this course we first examine different models of price and output decisions in imperfectly competitive markets. We then study other decisions that shape the structure of a market over time, including strategic entry barriers, mergers, vertical relations, product differentiation, R&D decisions, and competition among networks and two-sided platforms. Students use both game theoretic models and cases to analyze these interactions.
Prerequisites: ECO 146
Attribute/Distribution: Q, SS

ECO 324 The Economics of the Sports Industry 3 Credits
This course analyzes the role of basic economic forces in shaping today's sports industry. Topics include: competition in the market for professional franchises; public subsidies for stadiums and arenas; compensation of professional athletes; the NCAA as an economic enterprise; and the impact of athletics on a university's budget.
Prerequisites: ECO 146 and (ECO 045 or MATH 012 or MATH 231 or ISE 111)
Attribute/Distribution: Q, SS

ECO 325 (MKT 325) Consumer Insights through Data Analysis 3 Credits
Explores marketing analytic approaches aimed at improving the understanding of customers and customers' perceptions, thereby enhancing the effectiveness of marketing decision-making and implementation. Foundational data analysis techniques are examined in such areas as advertising, customer acquisition and retention (customer relationship management), segmentation, customer loyalty, lifetime-value analysis of the customer, pricing, sales force management, sales promotions, and new products. The development, implementation, and utilization of quantitative models on customer data are emphasized. Prerequisites as noted below.
Prerequisites: MKT 111 and ECO 146

ECO 328 (ECE 328) Electricity Economics 3 Credits
The course is intended primarily for students who are interested in an exploration of electricity markets around the world, risk management, operation, and the main considerations in the wake of a smart grid implementation as well as in the transition to a low carbon economy.
Repeat Status: Course may be repeated.
Prerequisites: ECO 001 and (MATH 023 or ECO 146)
Attribute/Distribution: CC, Q, SS

ECO 333 The Economics of Business Decisions 3 Credits
Students analyze business problems using economic logic and techniques like mathematical programming, marginal analysis, and decision making under risk and uncertainty. New topics like asymmetric information and the analysis of organizations are introduced. Case studies are emphasized.
Prerequisites: ECO 146 and (ECO 045 or MATH 012 or MATH 231 or ISE 111) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or (MATH 075 and MATH 076),)
Attribute/Distribution: Q, SS, W

ECO 335 Cost-Benefit Analysis 3 Credits
Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; rationale(s) for government intervention in free market economies; proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques and distributional consequences.
Prerequisites: ECO 146
Attribute/Distribution: Q, SS

ECO 336 Antitrust, Regulation, and the New Economy 3 Credits
Analyzes government responses to market power by examining antitrust policy and the regulation of natural monopoly. Focus in antitrust is on price-fixing, mergers, and dominant firms, and includes an introduction to the economics of platforms that highlights the new challenges they present. Analysis of regulation is focused on the problem of setting prices for a natural monopoly, on theories of regulation, and on the difficulties of deregulating.
Prerequisites: ECO 146
Attribute/Distribution: CC, Q, SS

ECO 338 International Economics 3 Credits
In trade (applied micro) graphical and mathematical analysis will be used to understand: why countries trade and the income-distributional effects; the gains from trade; the effects of government policies; and the reasons underlying the formation of trading blocs (e.g., TPP). In finance (applied macro) we will: examine the balance-of-payments accounts; develop international financial linkages (e.g., uncovered interest parity) and several exchange-rate models (e.g., the law of one price); and use models to understand macro policy-making in an open economy.
Prerequisites: (ECO 119 or ECO 229) and ECO 146
Attribute/Distribution: Q, SS

ECO 339 International Trade 3 Credits
The theory of international trade; the theory of tariffs; United States commercial policies; the impact of growth and development of the world economy.
Prerequisites: ECO 146
Attribute/Distribution: Q, SS

ECO 340 International Finance 3 Credits
The monetary side of an open economy and the financial transactions that accompany trade in goods and services. Macroeconomic links among participants in the global economy; currency and financial crises illustrate how difficult it is for countries to remain insulated from external shocks. Topics include: balance-of-payments accounting; exchange-rate models; and macroeconomic policies under different exchange-rate regimes and capital-mobility assumptions.
Prerequisites: ECO 119
Attribute/Distribution: Q, SS

ECO 342 The Chinese Economy - A Comprehensive Study 3 Credits
This course delves into the transformation of the Chinese economy, tracing its evolution from its pre-1978 foundations to the present. Through a universal analytical framework, students will explore key facets such as urban-rural dynamics, income inequalities, technological influences, and financial systems. The curriculum provides a foundation for critically assessing the sustainability of economic growth, applicable not just to China but to global economies at large.
Prerequisites: ECO 119 or ECO 146
Attribute/Distribution: Q, SS

ECO 345 Political Economy of Iraq 3 Credits
An examination of the economic, political and social forces at work in Iraq with emphasis on the post-2002 period. Major topics include recent history and culture, petroleum production and transport, corruption, agricultural transition, rural-urban divergence, unemployment, poverty, the economic and political role of the state owned enterprises, entrepreneurship and the informal economy, banking, and monetary, exchange rate, and fiscal policies.
Prerequisites: ECO 119 or ECO 303 or ECO 304 or IR 225
Attribute/Distribution: CC, SS

ECO 352 Behavioral Economics 3 Credits
The study of human behavior in economic contexts incorporating ideas from Psychology and other disciplines. Covers both theory and applications. Topics include non-standard preferences (e.g., loss-aversion), decisions under risk, intertemporal choices, heuristics and biases, and more.
Prerequisites: ECO 146 and (ECO 157 or ECO 357)
Attribute/Distribution: Q, SS, W

ECO 353 Public Economics 3 Credits
A course on the economic analysis of government. Major topics include the theory of public goods, the economics of taxation, the design of tax structures, externalities, and social insurance.
Prerequisites: ECO 146
Attribute/Distribution: Q, SS, W

ECO 357 Econometrics 3 Credits
Problems in construction, evaluation and use of econometric models. Applications based on research and case studies.
Prerequisites: (ECO 119 or ECO 146) and (BSTA 101 or ECO 157)
Attribute/Distribution: Q

ECO 358 Game Theory 3 Credits
This course introduces students to a set of tools that economists, among others, use to analyze strategic interactions among individuals, firms, nations, etc. The coverage of theories begins with single-person decision-making and extends to games (multi-person interactive decision-making) under various strategic and informational environments. Theories will be supplemented with a variety of applications, which include competitive pricing in oligopolistic markets, tragedy of the commons, bidding behavior in auctions, bargaining, voting and electoral competition, and strategic use and transmission of information.
Prerequisites: ECO 146 and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or (MATH 075 and MATH 076),)
Attribute/Distribution: CC, Q, SS

ECO 360 Time Series Analysis 3 Credits
This course provides an introduction to time series analysis as it is applied in macroeconomics and finance. The class will emphasize hands-on implementation of macroeconometric and time series models for macroeconomic, financial, and policy analysis. Topics include macroeconomic data, linear and nonlinear univariate time series models, practical issues with likelihood-based inference in time series models, forecasting, multivariate models, and structural identification in multivariate models.
Prerequisites: ECO 157
Attribute/Distribution: Q

ECO 362 Martindale Research Seminar 1-3 Credits
This course prepares students to undertake research on various topics in business and/or economics. Admission to this course is limited to student associates of the Martindale Center for the Study of Private Enterprise. Consent of the instructor is required. This course does not count towards an Economics Minor. For this course to be counted toward the Economics Major, department permission is required.
Repeat Status: Course may be repeated.
Attribute/Distribution: W

ECO 363 Labor Economics 3 Credits
The economic analysis of labor markets, with emphasis on labor supply and demand, wage and employment theory, and human capital. Further topics include the economics of discrimination, anti-poverty policies, and immigration. Students cannot receive credit for both ECO 235 and ECO 363.
Prerequisites: ECO 146
Attribute/Distribution: Q, SS

ECO 365 Business, Government, and Macroeconomic Policy 3 Credits
The course explores topics in applied macroeconomics, with emphasis on analyzing macroeconomic policy. Topics may include business cycles, fiscal and monetary policies, economic growth, consumption and saving decisions, exchange rate determination, and applicable empirical methods.
Prerequisites: ECO 229 or ECO 119
Attribute/Distribution: Q, SS

ECO 366 Quantitative Market Analysis 3 Credits
The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Basic knowledge of microeconomic theory and econometrics is required.
Prerequisites: ECO 146 and (ECO 157 or ECO 357)
Attribute/Distribution: Q

ECO 367 Applied Microeconometrics 3 Credits
An empirical class with concentration in Applied Microeconometrics. Its goal is to give you knowledge (various econometrics methods) and a tool (Stata) to solve real-life problems.
Prerequisites: ECO 357 or ECO 157
Attribute/Distribution: Q

ECO 368 Health Economics 3 Credits
Supply and demand in the U.S. health service market. Unique features of health care which interfere with competitive market allocation and pricing. Overview of insurance systems and other payment methods.
Prerequisites: (ECO 045 or MATH 012 or MATH 231) and ECO 146
Attribute/Distribution: Q, SS

ECO 369 Analysis of Health Care Markets 3 Credits
The economic analysis of health care supply in the U.S. This course focuses on provider behavior, market competition, and financing. Students will learn how the supply side interacts with health insurers, the government, and consumers to determine market outcomes, including the price, quantity, and quality of health care. The course emphasizes the role of public policy in shaping supply-side provider decisions and influencing market competition among providers.
Prerequisites: ECO 146 and (ECO 045 or MATH 012 or MATH 231 or BSTA 001)
Attribute/Distribution: Q, SS

ECO 371 Special Topics in Economics 1-3 Credits
Study in various fields of economics, designed for the student who has a special interest in a subject not included in the regular course schedule or for the student interested in pursuing a significant supervised research project in economics. Students interested in enrolling in this course must submit a written proposal to a member of the faculty with expertise in the proposed subject area and to the department chair prior to the registration period for the relevant semester.
Repeat Status: Course may be repeated.
Prerequisites: ECO 146 or ECO 119
Attribute/Distribution: SS

ECO 389 Honors Project 1-6 Credits
Independent research under faculty supervision, culminating in a thesis presented for departmental honors.
Repeat Status: Course may be repeated.
Attribute/Distribution: Q, SS, W

ECO 402 Managerial Economics 3 Credits
Application of economic and statistical analysis to managerial decision-making. Business and economic forecasting. Empirical estimation of demand, production, and cost functions. Resource allocation and pricing strategies in various market structures. Decisions under risk and uncertainty. Government regulation of business cases.
Prerequisites: MATH 021 and (MATH 022 or MATH 096) and ECO 401

ECO 403 Econometric Software 3 Credits
The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Students will develop data management and programming skills using the Stata or SAS system. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course, students will be able to manage data to boost their research and analysis skills.

ECO 404 Applied Microeconometrics 3 Credits
The purpose of this course is to expose students to econometric techniques frequently used in applied microeconomic research. The course features critical reading of empirical research papers and the implementation of econometric methods on actual data sets.

ECO 409 Money, Banking and Macroeconomic Analysis 2 Credits
The role of financial intermediation in the U.S. economy, the process of money creation, impacts of fiscal and/or monetary policy on the goals of macroeconomic policy, inflation and unemployment.

ECO 412 Mathematical Economics 3 Credits
Applications of various mathematical techniques in the formation and development of economic concepts and theories. Consent of instructor required.

ECO 413 Advanced Microeconomics Analysis 3 Credits
A survey of methods of decision-making at the microeconomic level; price theory and econometric applications.

ECO 414 Advanced Topics in Microeconomics 3 Credits
Resource allocation and price determination. Theories of choice of consumers, firms, and resource owners under various market forms.
Prerequisites: ECO 413

ECO 415 Econometrics I 3 Credits
Computer applications of standard econometric techniques using regression analysis in a single-equation context. Discussion of problems of multicollinearity, heteroscedasticity and autocorrelation. An introduction to simultaneous equation models, identification and estimation problems.

ECO 416 Econometrics II 3 Credits
Mathematical and statistical specification of economic models. Statistical estimation and tests of parameters in single and multiple equation models. Prediction and tests of structural change.
Prerequisites: ECO 415

ECO 417 Advanced Macroeconomic Analysis 3 Credits
This course aims to familiarize students with the current research in modern empirical macroeconomics, with emphasis on the intersection of theoretical models and macroeconomic policy analysis.

ECO 418 Advanced Topics in Macroeconomics 3 Credits
Models of employment, income and growth in monetary economies. Policies for economic stability and growth.
Prerequisites: ECO 417

ECO 425 Cost-Benefit Analysis 3 Credits
Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; rationale(s) for government intervention in free market economies; proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques and distributional consequences.
Prerequisites: ECO 402 and ECO 415

ECO 427 Statistical Analysis for Management 2 Credits
Descriptive statistical measures, probability and probability distributions, statistical inference (estimation and hypothesis testing), correlation and regression. EXCEL will be used for statistical computing.

ECO 428 (ECE 428) Electricity Economics 3 Credits
Course focuses on the intersection between economics & electricity systems, and market structures available in the electric energy industry. Background provided on basic economic theory applied to power systems to understand operations objectives, pricing & incentives, as well as non-perfect competition situations that arise in the network. Different dispatch optimization problems used in electricity market restructuring, approaches to solving these, and the existence of non-convex markets will be discussed. Credit will not be given for both ECO/ECE328 and ECO/ECE428.

ECO 430 Public Finance 3 Credits
The economics of public spending and taxation; principles of government debt management; theories of budgeting and cost-benefit analysis and public choice.

ECO 431 Quantitative Market Analysis 3 Credits
The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Students cannot receive credit for both ECO 366 and ECO431.

ECO 440 Labor Economics I 3 Credits
The economics of labor markets and various labor-market institutions with emphasis on current theoretical and empirical research. Topics include labor supply and demand, human capital, the structure of labor markets, labor market regulation, information and job search, labor mobility, unionism, and labor market discrimination.
Prerequisites: ECO 401 and ECO 402

ECO 441 Labor Economics II 3 Credits
An examination of empirical research in labor economics, focusing on topics such as human resource management and internal labor market outcomes, wage and income inequality, and poverty, unemployment, and other issues current in the literature.
Prerequisites: ECO 415

ECO 447 Economic Analysis of Market Competition 3 Credits
Mathematical models based on game theory and industrial organization. Cases are used to analyze the strategic interaction of firms and governments as competitors and partners.
Prerequisites: ECO 402

ECO 448 Business Economics 3 Credits
Applications of economic analysis to business decision-making; technology in economic systems; resource allocation and pricing strategies in various market structures; decisions under risk and uncertainty; and government regulation and support of business and innovation.

ECO 452 Behavioral Economics 3 Credits
The study of human behavior in economic contexts incorporating ideas from Psychology and other disciplines. Covers both theory and applications. Topics include non-standard preferences (e.g., loss-aversion), decisions under risk, intertemporal choices, heuristics and biases, and more.

ECO 455 Health Economics I 3 Credits
Economic theory and empirical analysis of health production, the demand for health services, and health insurance. Implications for the current institutional structure of health care and health delivery systems will also be discussed. Additional topics and extensions will be selected based on developments in the literature.
Prerequisites: ECO 416

ECO 456 Industrial Organization 3 Credits
The goal of the course is to review theoretical and empirical attempts by economists to understand market structures lying between the extremes of perfect competition and monopoly. The course will focus first on describing the current U.S. industrial structure and reviewing models of imperfect competition. The course then shifts to a closer study of individual firm behavior. The final segment of the course is an overview of two significant relationships between government and industry caused by the existence of imperfect.
Prerequisites: ECO 415 and ECO 447

ECO 460 Time Series Analysis 3 Credits
Classical decomposition of time series, trend analysis, exponential smoothing, spectral analysis and Box-Jenkins autoregressive and moving average methods.

ECO 463 Topics in Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations. Topics include normal-form and extensive-form representations of games, various types of equilibrium requirements, the existence and characterization of equilibria, and mechanism design. The analysis is applied to micro-economic problems including industrial organization, inter-national trade, and finance.

ECO 464 Applied Econometrics I 3 Credits
This course focuses on the identification of causal relationships using cross-sectional and panel data. The objectives are to 1) familiarize students with identification assumptions for causal inference; and 2) enable students to select appropriate econometric tools for empirical economic problems and policy evaluation.Topics include robust inference and bootstrap; instrumental variables and generalized method of moments (GMM); quantile and nonparametric regression methods; treatment effect analysis, and models for discrete choices, panel data, and social interactions.
Prerequisites: ECO 416

ECO 465 Applied Econometrics II 3 Credits
Econometric analysis of skewed and truncated distributions, discrete outcomes, and missing or incomplete data. The first part of this course will involve the functional specification and testing of appropriate estimators in these situations, while the second part of the course will focus on conducting causal inference using nonlinear models in the presence of unobserved heterogeneity. Emphasis will be given to common applications in health and labor economics.
Prerequisites: ECO 416

ECO 466 Health Economics II 3 Credits
Selected topics in the literature on health economics with an emphasis on the application and evaluation of econometric techniques and identification strategies. Both demand and supply side issues will be addressed. Examples of the former include the demand for health, health insurance and health care services, while examples of the latter include the regulation of supplier behavior and industrial organization issues.
Prerequisites: ECO 416

ECO 490 Master's Thesis 1-6 Credits
Master's Thesis.

ECO 492 Special Topics in Economics 1-3 Credits
Extended study of an approved topic not covered in scheduled courses.
Repeat Status: Course may be repeated.

ECO 493 Doctoral Pre-Dissertation Research Project - Independent Study 1-9 Credits
Independent study on a topic that is being pursued to fulfill the third year paper requirement, and has been approved by the student's interim advisor.

ECO 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Entrepreneurship

Entrepreneurship-related programs and activities are university-wide. Entrepreneurship curriculum is overseen by a joint committee of faculty from CBE, CAS and RCEAS.

MINOR IN ENTREPRENEURSHIP

Open to all undergraduate students, from any major.

The purpose is to enable students in any major to supplement their major with a creative entrepreneurial mindset and skills that increase their ability to identify opportunities for innovation, to challenge the status quo in any field, and to implement sustainable change, whether in emerging or established companies or non-profit enterprises. The program is designed to be accessible to students from all disciplines with an emphasis upon innovation, entrepreneurial thinking and creative processes, cross-functional integration, and hands-on experiential practice. The minor leverages the resources and support of the Baker Institute for Entrepreneurship, Creativity, and Innovation, as well as a broad array of related programs and infrastructure across the university.

We encourage participation by those interested in all types of entrepreneurship, including business and technical entrepreneurship but also not-for-profit contexts aiming for social, cultural and environmental change. Throughout the multi-disciplinary, team-based curriculum, students are encouraged to work either on their own entrepreneurial projects, projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs.

Recommended Tracks

Students may select any set of courses that fulfill the minor requirements. However students are encouraged consult with the minor director to design a focused track, such as New Venture, Technology Entrepreneurship, Social & Non-profit Entrepreneurship, Arts Entrepreneurship, Service-sector Entrepreneurship, or others. The recommended approach for a focused track begins with the introductory ENTP 101 and closes with in-depth hands-on capstone entrepreneurial experiences, sandwiched around a flexible package of courses selected by each student as needed to foster their particular entrepreneurial interests and goals.

Requirements

ENTREPRENEURSHIP

Entrepreneurship-related programs and activities are university-wide. Entrepreneurship curriculum is overseen by a joint committee of faculty from across the university.

MINOR IN ENTREPRENEURSHIP

Open to all undergraduate students, from any major.

The purpose is to enable students in any major to supplement their major with a creative entrepreneurial mindset and skills that increase their ability to identify opportunities for innovation, to challenge the status quo in any field, and to implement sustainable change, whether in emerging or established companies or non-profit enterprises. The program is designed to be accessible to students from all disciplines with an emphasis upon innovation, entrepreneurial thinking and creative processes, cross-functional integration, and hands-on experiential practice. The minor leverages the resources and support of the Baker Institute for Entrepreneurship, Creativity, and Innovation, as well as a broad array of related programs and infrastructure across the university.

We encourage participation by those interested in all types of entrepreneurship, including business and technical entrepreneurship but also not-for-profit contexts aiming for social, cultural and environmental change. Throughout the multi-disciplinary, team-based curriculum, students are encouraged to work either on their own entrepreneurial projects, projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs.

REQUIREMENTS

The minor has a prerequisite of ECO 001 (4 credit hours) and then requires at least 12 credit hours of ENTP and capstone courses.

Prerequisite Course		
ECO 001	Principles of Economics [1]	4
Required Courses		
ENTP 101	Introduction to Entrepreneurship (required)	3
Select at least 6 credit hours in other ENTP courses [2]		6
Select at least one (minimum 3 credit hours) of the following experiential Capstone courses: [3]		3
ENTP/MGT 311	The Garage: Launching Entrepreneurial Ventures I	
ENTP/MGT 312	The Garage: Launching Entrepreneurial Ventures II	
ENTP/CSB 304	Technology and Software Ventures	
ENTP 307	International Social Entrepreneurship	
ENTP/POLS 310	Social Entrepreneurship: How to Change the World	
IBE 380	Integrated Business and Engineering Capstone Project I	
IBE 385	Integrated Business and Engineering Capstone Project II	
CSB 312	Design of Integrated Business Applications I	
CSB 313	Design of Integrated Business Applications II	
ME/BIOE/MAT 211	Capstone Design Project I	
ME/BIOE/MAT 212	Capstone Design Project II	
Other independent experiential project approved by the minor director		
Total Credits		12

[1] ECO 001 Principles of Economics (4 credit hours) must be completed prior to enrolling in the minor. Students may enroll in ENTP 101 without ECO 001, but may not sign up for the minor until completing ECO 001.
[2] Or alternatives approved by the minor director in consultation with the student.

[3] Or alternatives approved by the minor director.

Students must complete the minor with an average GPA of at least 2.0 in those courses to qualify.

Only one course may overlap with the student's major. Students pursuing multiple majors cannot overlap more than one course, regardless of the number of majors declared.

Courses taught and/or cross-listed in the College of Business do not count as non-business courses. Additionally, ENTP 315 and ENTP 371 do not count as non-business courses.

Course descriptions for the Entrepreneurship graduate courses can be located under Master of Engineering in Technical Entrepreneurship. (p. 510)

Courses

ENTP 101 Introduction to Entrepreneurship 3 Credits
Introduction to the nature of entrepreneurship and the entrepreneurial mindset. Emphasis on identifying opportunities, generating creative ideas, and the process of scaling up sustainable organizations. Topics include: alternative concepts of entrepreneurship and social entrepreneurship; personal attributes of entrepreneurs; steps in new venture creation; introduction to entrepreneurial finance and marketing; new venture planning for both emerging and existing enterprises. Uses case studies, hands-on experiential teams, and exposure though guest speakers to successful entrepreneurs and to Lehigh and community resources for entrepreneurs.
Attribute/Distribution: ND

ENTP 201 (MGT 201) Entrepreneurship & Enterprise 3 Credits
This course provides an overview of the skills and steps needed to successfully launch new ventures. We will examine the entrepreneurial mindset and emphasize topics such as opportunity scanning, identification, and evaluation, informal networking, resource acquisition, business models, financing and debt, new venture strategies, developing a leadership team and a creative culture, managing change, ethics, franchising, and exit strategies. The course serves as a foundation for students who might own a business some day and/or work in a startup.
Prerequisites: ENTP 101 or MGT 043 or MGT 143

ENTP 250 (TE 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, painstorming, bisociation, the Kano model, trimming technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).
Attribute/Distribution: ND

ENTP 302 (MGT 302) Corporate Entrepreneurship and Innovation 3 Credits
This course explores the role of innovation in enterprise growth. Through assigned readings, cases, and group projects we explore the organizational and individual challenges associated with pursuing innovation as a driver of firm growth. The course also explores the tension between tradition and innovation as applicable to large family businesses including some of the most enduring ones (e.g., Ford, Dell, Walmart, BMW). The course uses a live case where students work with a real enterprise to develop a growth solution.
Prerequisites: ENTP 101 or MGT 043 or MGT 143

ENTP 304 (CSB 304) Technology and Software Ventures 3 Credits
Designed from the perspective of functional leaders, course provides a holistic perspective of developing successful software ventures across various industries in an interdisciplinary and experiential environment. Students develop a software-oriented idea, concurrent with module delivery containing best practices, case studies, and subject-matter experts. Examines business model fundamentals, customer discovery, translating requirements to a minimum viable product, agile development, user acquisition, and traction. ENTP Capstone. Prior programming experience or technical background not required. Open to students in any college and major.
Prerequisites: ENTP 101 or CSE 002 or BIS 111

ENTP 306 (MGT 306) Decision Making and Problem Solving in Business 3 Credits
The course will provide the foundational hard and soft-skills consulting firms employ to identify and diagnose business problems, generate data, formulate innovative solutions, and effectively communicate recommendations. The course will blend lecture with experiential learning.

ENTP 308 Creating and Sustaining a Non-Profit 3 Credits
Non-profit organizations can be effective institutional agents of change, if you know what you are doing. This class will make sure you do. Students will learn the nuts and bolts of creating and sustaining a non-profit, including recruiting and managing a board of directors, fundraising, marketing, program planning and evaluation. We will also explore the ethics, values and drive necessary to be an effective leader of a non-profit (SS).
Attribute/Distribution: SS

ENTP 309 (POLS 309) Nonprofit Administration 4 Credits
Key questions in nonprofit sector research, policy, & management and factors that make the nonprofit sector distinct. Scope & character of nonprofit activity in the U.S. & abroad. Current debates in nonprofit policy and critical challenges facing management.
Attribute/Distribution: SS

ENTP 310 (POLS 310) Social Entrepreneurship: How to Change the World 4 Credits
The marketplace does not always have to be harsh. Social entrepreneurship uses market-based approaches to address needs and solve problems in our society. Students in this seminar-style course will learn how to identify community problems, convince the community that it is a problem worth solving, design the response, and implement it. Hands-on projects. Must have junior standing or higher.
Prerequisites: ECO 001
Attribute/Distribution: SS

ENTP 311 (MGT 311) The Garage: Launching Entrepreneurial Ventures I 3 Credits
Students work in cross-disciplinary teams with faculty advisors and alumni mentors on marketing, financial planning, and economic and technical feasibility of entrepreneurial product- or service-based new ventures, commercial or non-profit. Students may elect to work either on their own entrepreneurial projects, on projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs. Oral presentations, written new venture plans and discussions with guest speakers are integral parts of the course. Consent of minor director.
Prerequisites: ENTP 101 or MGT 043 or MGT 143
Attribute/Distribution: ND

ENTP 312 (MGT 312) The Garage: Launching Entrepreneurial Ventures II 3 Credits
Continuation of ENTP 311. Investigates and pursues in detail the critical steps and activities necessary when entrepreneurs seriously pursue launching new ventures.
Prerequisites: ENTP 311

ENTP 315 Lehigh Silicon Valley 1-4 Credits
Immersion study-abroad-like program about the creation of venture capital-backed companies. Offered in the hub of entrepreneurship, Silicon Valley, where countless ventures emerge, particularly in disruptive technologies, nextgen software and Internet. “Live cases” draw on seasoned practitioners from all reaches of the venture community. Students encounter a highly charged learning environment focused on real companies, real players, and real situations in real time. Offered January winter term. Includes pre-trip sessions and pre-and post-trip assignments. Admission by competitive application. Program fees.
Attribute/Distribution: ND

ENTP 319 (MKT 319) Innovation and Marketing of New Products 3 Credits
This course adopts the marketing philosophy that new products and services will be profitable if the extended product provides customers with highly valued benefits. The goal is to help students learn how to use state-of-the-art management techniques to identify markets, develop new product ideas, measure customer benefits, and design profitable new products. The course provides techniques to interface the marketing function with the functions of R&D, design engineering, and manufacturing.
Prerequisites: MKT 111

ENTP 320 (BIOS 320) The Business of Life Science 3 Credits
An examination of business process in startup, early stage and developing bioscience companies. Technology assessment, business plan and proposal preparation, financial strategies, resource management, intellectual property, and legal as well as regulatory issues. Cannot be used to fulfill major requirements in BIOS.
Prerequisites: BIOS 121
Attribute/Distribution: NS

ENTP 366 (MKT 366) Services Marketing and Innovation 3 Credits
While manufacturing giants all consider themselves service-related companies, services are moving to the forefront of industry value proposition offerings. This course focuses on issues related to service design and marketing on a broad basis, and its implication to retailing in particular. The course enables students to gain an understanding of the special challenges evident in marketing services and to acquire a unique set of knowledge and skills beyond the traditional strategies designed for product goods. Illustrative topics include fundamental differences.
Prerequisites: MKT 111

ENTP 371 Independent Study in Entrepreneurship or Social Ventures 1-4 Credits
Study and projects in entrepreneurship or social ventures; designed for the student who has a special interest in a subject not included in the regular course schedule or interested in pursuing a significant supervised project in entrepreneurship. Interested students should seek agreement from a willing faculty adviser prior to enrolling. Consent of minor director required, This course may count towards the ENTP minor only once.
Repeat Status: Course may be repeated.

ENTP 372 Special Topics in Entrepreneurship or Social Ventures 1-4 Credits
Special problems and issues in entrepreneurship or social ventures for which no regularly scheduled course exists. Coverage will vary according to the interests of the instructor and students. Consent of minor director required.
Repeat Status: Course may be repeated.

ENTP 389 Honors Project 1-4 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. Transcript will identify department in which project was completed. Consent of department required.

Finance

Finance is an increasingly complex and important component of the competitive global economy. Consequently, there are myriad career opportunities within financial services at corporations, investment firms, and financial institutions worldwide. To complete the finance major, students must take seven courses comprised of both required and elective components for a total of at least 21 credits. Required courses provide a solid foundation, while electives enable students to tailor their studies to specific career goals.

Students are also encouraged to engage in discipline-specific extracurricular activities as a complement to their formal academic studies. This may include student managed investment funds, clubs/societies, visiting speakers, field trips, conferences/symposia, internships, and networking events with alumni and industry professionals. Lehigh enjoys a relative advantage in this regard given an alumni base that is well respected in all areas of finance and the University's proximity to major financial institutions and markets. To expand their knowledge dimensions, majors can also undertake minors that are related to finance such as the Real Estate Minor or the FinTech Minor

The finance major offered by the Perella Department of Finance requires at least 21 credit hours beyond the College of Business core. All candidates must successfully complete foundational courses in Investments and Corporate Finance along with 5 elective courses selected from a list of approved offerings. Three electives must be finance courses (FIN prefix), while the remaining two electives may be selected from a wider range of courses in finance, accounting, economics, mathematics, and real estate as outlined below. All courses must be at least 3 credits. Provisional courses (except offerings by the Finance Department) are not acceptable as electives for the finance major.

2-Course Foundation Requirement		**6**
FIN 323	Investments	
FIN 328	Corporate Financial Policy	
5-Course Elective Requirement (Choose 5 courses from the following, at least 3 of which must have a FIN prefix)		**15-17**
FIN 324	Security Analysis and Portfolio Management	
FIN 330	Financial Markets and Institutions	
FIN 333	Global Finance	
FIN 334	Derivatives and Management of Risk	
FIN 335	Advanced Topics – Financial Management (Various Topics can be offered under this course number. It may be taken more than once if different topics are selected.)	
FIN 336	Real Estate Finance	
FIN 337	Financial Market Regulation and Innovation	
FIN 377	Advanced Topics--Investments (Various topics can be offered under this course listing. Various Topics can be offered under this course number. It may be taken more than once if different topics are selected.)	
.		
ACCT XXX	Course ACCT XXX Not Found (Any 300 level Accounting course of at least 3 credits [except ACCT 371 and 372]. Provisional courses, except offerings by the Finance Department, are not acceptable as electives.)	
ECO XXX	Course ECO XXX Not Found (Any 200 level (or higher) Economics course of at least 3 credits [except ECO 201, 259, 273, 274, 300, 362, 371, and 389]. Provisional courses, except offerings by the Finance Department, are not acceptable as electives.)	
REAL XXX	Course REAL XXX Not Found (Any 300 level Real Estate course of at least 3 credits [Can only count 1 REAL course if also taking FIN 336].)	
.		
ISE 121	Applied Engineering Statistics	
ISE 316	Optimization Models and Applications	
ISE 339	Stochastic Models and Applications	
.		
MATH 205	Linear Methods	
MATH 231	Probability and Statistics	
MATH 241	Applied Linear Algebra	
MATH 263	Introduction to the Theory of Probability	

MATH 310	Random Processes and Applications	
Total Credits		**21-23**

Undergraduate Courses

For Advanced Undergraduates and Graduate Students

Courses numbered 200 and above in the College of Business are open to sophomores only on petition.

Graduate Courses

Course descriptions for the College of Business graduate courses can be found under the heading of Business Graduate Courses.

Courses

FIN 125 Introduction to Finance 0,3 Credits
An introductory finance course that provides students with the basic finance skills and knowledge needed to undertake downstream courses in the finance major. Major topic areas will include time value of money, risk and return valuation of stocks and bonds, capital budgeting, cost of capital, and financial statement analysis.
Prerequisites: ACCT 151 and (ECO 145 or ECO 045 or MATH 231 or ISE 111 or IE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 076 or MATH 081)
Can be taken Concurrently: ACCT 151

FIN 273 Finance Internship I 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a "capstone report." It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail and cannot be used to satisfy finance major requirements. Declaration of a finance major. Consent of department required.
Prerequisites: (ECO 129 or ECO 029 and ACCT 151) and (ECO 145 or ECO 045 or MATH 231 or ISE 111 or IE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 076 or MATH 097 or MATH 081)

FIN 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

FIN 323 Investments 3 Credits
This course covers the concepts of risk and returns on financial assets from the viewpoint of various constituents. Investor objectives, attitudes, and constraints are considered within the risk-return matrix. Concepts of valuation are covered. Prerequisites: FIN 125. The course is open to sophomores with the appropriate prerequisites.
Prerequisites: FIN 125

FIN 324 Security Analysis and Portfolio Management 3 Credits
The course will expose students to the concept of Corporate Valuation via Equity and Debt instruments including examining transactions and events leading to market crashes. Forecasting models will be used. Coverage includes: portfolio management concepts, market factors, technical analysis, timing, and screening of securities. Online version is designed for maximum flexibility (access to instructor, optional group work, recorded video and live sessions) enabling students to pursue professional interests.
Prerequisites: FIN 323 and FIN 328

FIN 328 Corporate Financial Policy 3 Credits
The study of corporate financial management issues related to capital budgeting, working capital, capital structure, mergers, and financing. Prerequisites: FIN 125. The course is open to sophomores with the appropriate prerequisites.
Prerequisites: FIN 125

FIN 330 Financial Markets and Institutions 3 Credits
Functions and portfolios of financial intermediaries. Sectional demand and supply of funds, nature and role of interest rates, term structure and forecasting, impact of inflation and regulation on financial intermediaries and markets, and current developments in the financial system. Management of assets and liabilities within the U.S. financial institution's legal and economic constraints.
Prerequisites: (FIN 323 and FIN 328)

FIN 333 Global Finance 3 Credits
Issues that underlie the investment, financing, and dividend decisions of multinational firms from both the buyer's and seller's viewpoints. Current transactions in foreign currencies, direct and portfolio investment and associated risk management when dealing in foreign countries.
Prerequisites: (FIN 328 and FIN 323)

FIN 334 Derivatives and Management of Risk 3 Credits
Theoretical and practical aspects of various instruments and markets that involve financial derivative instruments. Emphasis on the management of risk for corporate managers and portfolio managers.
Prerequisites: (FIN 323 and FIN 328)

FIN 335 Advanced Topics – Financial Management 3 Credits
Advanced topics relating to specific areas of corporate finance such as: bond refunding, asset valuation and capital budgeting including the role of uncertainty, imprecise forecasts, risk preferences, inflation, market conditions, and the global marketplace; working capital management, leasing, mergers, and financing. The course content may vary between instructors and over time, therefore, the course descriptor is subject to change each time the is offered.
Repeat Status: Course may be repeated.
Prerequisites: (FIN 328 and FIN 323)

FIN 336 Real Estate Finance 3 Credits
An advanced survey of modern residential and commercial real estate financing techniques from the perspective of the borrower and the lender. Topics include: the principles of financing decisions; financing methods and techniques, institutional sources of funds for real estate, and real estate financing decision-making. The course includes lectures, demonstrations, spreadsheet software exercises, and guest speakers.
Prerequisites: (FIN 328 and FIN 323)

FIN 337 Financial Market Regulation and Innovation 3 Credits
In FIN 337, students gain an in-depth knowledge of financial market regulation, its intent, and effect on intermediaries/markets. Since this course provides the finance foundations for the FinTech minor, advances in the use of technology throughout financial services and the role of innovation will be explored. The course combines lecture and case materials to understand the economic and regulatory environment surrounding markets and the disruption/opportunities arising from financial technology.
Prerequisites: FIN 323 and FIN 328

FIN 371 Directed Readings 1-3 Credits
Readings in various fields of finance designed for the student with a special interest in some field of finance not covered in scheduled courses. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

FIN 372 Special Topics 1-3 Credits
Special problems and issues in finance for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of instructor and students. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

FIN 373 Finance Internship II 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a "capstone report." It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work.Course content and work experience should have added rigor from Finance Internship I due to the satisfactory completion of the finance core (FIN 323 and FIN 328).Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail and cannot be used to satisfy finance major requirements. Declaration of a finance major. Consent of department required.
Prerequisites: (FIN 323 and FIN 328)

FIN 374 Portfolio Management Practicum 1 Credit
Readings, projects and papers designed to complement the leadership and analytical activities associated with the management of the Student Investment Club or Thompson portfolios and similar activities. Consent of instructor required.
Repeat Status: Course may be repeated.

FIN 377 Advanced Topics--Investments 3 Credits
Advanced topics to specific areas of Investments such as: valuation/ security analysis; portfolio/risk management; fixed income securities; mutual funds; hedge funds; microstructure; and trading.
Repeat Status: Course may be repeated.
Prerequisites: FIN 323 and FIN 328

FIN 382 Guest Speaker Seminar Series 1 Credit
This course is designed to help prepare students for 'real' world problems by exposing them to a variety of career opportunitites. The purpose of this seminar is to give students the opportunity to network with successful professionals in the Financial Services industry, connecting students and practitioners across places and generations to build community around shared work-as-service interests. For future professionals, this seminar advances co-curricular programming to the "pro-curricular" level – linking classroom study of finance to the dynamic world of the practicing financial professionals.
Repeat Status: Course may be repeated.

FIN 388 FinTech Capstone 3 Credits
This course combines experiential learning via a semester long hands-on project with a series of lectures on relevant topics. Students will learn how to apply the information technologies and financial concepts they learned in the other courses to issues in the creation, distribution, servicing, or operations of financial products and services. These issues may include cybersecurity, payment processing, algorithmic trading, credit scoring, blockchain, cryptocurrency, artificial intelligence, machine learning, peer-to-peer lending, online banking, and mobile banking.
Prerequisites: (CSE 012 or CSE 017) and BIS 352 and (BIS 348 or CSE 347 or ISE 364 or ISE 365) and (BIS 324 or CSE 241 or ISE 224) and FIN 330

FIN 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

FIN 418 Principles of Corporate Finance and Investments 3 Credits
This course provides students with a basic foundational knowledge of finance principles, working knowledge of various aspects of corporate finance, and the principles of investments. Short-term financial decisions will be discussed. Long-term capital investment will be explored starting with the basics of time value of money and capital investment techniques. Topics include the determination of the appropriate investment discount rate, the organizationâ€™s cost of capital and hurdle rates, the risk-reward tradeoff, and specific financial instruments.

FIN 433 Financial Analysis for Managers 3 Credits
The class introduces the key elements of financial reporting, budgeting, and analysis in corporate finance decision-making. From understanding the financial statements to implementing strategic plans, operational budgets, and financial forecasts, the course prepares students to make capital-investment decisions that lead to improved financial efficiencies and operating performance.
Prerequisites: MGT 431 and GBUS 401
Can be taken Concurrently: MGT 431

Financial Technology

Financial Technology (FinTech) is at the intersection of big data and financial services. Many disruptive technologies such as cryptocurrency, blockchain, mobile banking, machine learning, and robo-advising have been applied in the financial services sector to create new and improved products and to increase efficiency.

This minor provides advanced classes in both financial concepts and allows the student to choose classes from different areas of computer and information technology. The course of study culminates in a capstone class is intended to expose the student to a real-world problem in FinTech.

The FinTech minor is composed of 4 courses (12 credits), and is open to all College of Business students with a declared major, CSB, and IBE students. The prerequisite courses for the minor are the same as for the finance major: FIN 125, FIN 323, and FIN 328. Depending on the electives chosen, there may be additional prerequisites. Note College of Business majors and College of Business minors cannot overlap and therefore, any courses taken for a minor cannot also count for the major.

The course of study consists of :

1. FIN 337 Financial Market Regulation

2. FIN 388: FinTech Capstone

3. Two electives from the following list (only one of which may be taken concurrently with the Capstone)

a. Data Analytics

i. FIN 377 Data Science for Finance (Spring, Prerequisites: FIN 323, FIN 328)

ii. ACCT 330 Accounting Data and Analytics (Prerequisites: ECO 45)

iii. BUAN 348 Predictive Analytics in Business (Prerequisites: BIS 111 and (ECO 45 or MATH 012 or MATH 231))

iv. BUAN 352 Business Analytics and Modelling (Fall, Prerequisites: BIS 111 and (ECO 45 or MATH 012 or MATH 231))

b. Artificial Intelligence

i. BUAN 357 Artificial Intelligence for Business

ii. CSE 127 (COGS 127) Survey of Artificial Intelligence (Prerequisites: CSE 002 or CSE 004 or CSE 007)

iii. CSE 327 (COGS 327) Artificial Intelligence Theory and Practice (Prerequisites: CSE 017 and CSE 140)

c. Natural Language Processing

i. CSE 325 Natural Language Processing (Prerequisites: (MATH 231 or ECO 045) and CSE 017)

d. Data Mining

i. ISE 365 Applied Data Mining (Prerequisites: ISE 121 or IE 121 or ISE 328 or IE 328)

ii. ISE 367 Mining of Large Datasets (Prerequisites: ISE 111 and CSE 002)

e. Machine Learning

i. ISE 364 Introduction to Machine Learning (Prerequisites: CSE 002)

ii. CSE 326 Fundamentals of Machine Learning (Prerequisites: (CSE 002 or CSE 012) and (MATH 205 or MATH 043) and (MATH 231 or ISE 121 or ECO 045))

iii. MATH 365 Statistical Machine Learning (Prerequisites: (MATH 205 or MATH 241 or MATH 242) and (MATH 264 or MATH 312) and (MATH 263 or MATH 309))

f. Blockchain

i. CSB 242 Blockchain Concepts and Applications (Prerequisites: ECO 001 and (BIS 111 or CSE 001 or CSE 002 or CSE 012) and (CSE 017 or MKT 111 or FIN 125 or SCM 186))

ii. CSE 242 Blockchain Algorithms and Systems (Prerequisites: CSE 017 and (CSE 241/341 or CSE 109 (concurrent))

Law

Every College of Business student is required to take Law 201 as part of the College of Business Core.

The following undergraduate law courses are offered through the Perella Department of Finance:

Course descriptions for the College of Business graduate courses can be found in the Courses tab. Prerequisite: consent of sponsoring instructor.

Courses

LAW 101 Introduction to Law 3 Credits
A study of the nature and function of law and the legal system, the study of legal reasoning through the use of the case method.

LAW 102 Sports Law 3 Credits
The study of legal relationships and legal topics of individuals, organizations, society, and the government as they relate to sports. The case method will be used to examine landmark cases and current day examples of legal principles and precedent.

LAW 201 Legal Environment of Business 0,3 Credits
This course examines the legal relationships between business and government, business and society, and the individual and society. A significant focus of the course is on the structure of the U.S. legal system, the role of the courts in the legal system, and contract law as the principal mechanism for the private allocation of resources and risk allocation. The course also focuses on business ethics with particular emphasis on corporate social responsibility. Junior standing is required.
Prerequisites: (ECO 001)

LAW 202 Business Law 3 Credits
The law of agency, business organizations, secured transactions, bankruptcy and negotiable instruments.
Prerequisites: (LAW 201)

LAW 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

LAW 371 Directed Readings 1-3 Credits
Readings in various fields of law, designed for students who have a special interest in a field of law. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

LAW 372 Special Topics 1-3 Credits
Special problems and issues in law for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of instructor and students. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

LAW 417 Regulatory Environment of Business 2 Credits
This course is designed to provide students with a basic understanding of the various legal, regulatory, and market constraints in which business operates. Students are introduced to the interplay between legislation, regulations, and court decisions in establishing the regulatory environment in which a business operates as well the allocation of power among federal and state authorities. Conflict of law issues will also be explored for businesses that operate internationally. Contract law, forms of business, and ethics are covered in depth.

Management

The Management major introduces management principles, theories, and experiences to students who want careers in management; who want to be leaders in organizations, small or large, private or public, for profit or nonprofit. The major is designed to give students the knowledge and abilities required to succeed in Management Consulting, Human Resources and Organizational Management, as well as those required to embark on an Entrepreneurship and Innovation trajectory emphasizing the development of skills in diagnosing business problems, formulating innovative solutions for markets and firms, and effectively communicating recommendations.

There are three distinct tracks to the major.

Managing Human Resources: This track prepares students to work as human resource professionals as well as broaden their interpersonal skills.

Management Consulting: This track prepares students to enter careers in management consulting by training them to diagnose and solve business problems.

Entrepreneurship and Innovation: This track prepares students to launch new and/or innovative solutions for markets and firms, and develops an entrepreneurial mindset.

Each track of the Management Major is comprised of 5 courses (15 credits).

Managing Human Resources

Required		
MGT 333	Human Resource Management	3
MGT/SCM 328	Negotiations and Conflict Management	3
MGT 363	Managing Diversity and Inclusion in the Workplace	3
Plus 2 from the following courses:		**6**
ECO 235	Labor Economics	3
MGT 374	Societal Shifts	3
MGT 342	Managing in the International Organization [1]	3
Diversity, Equity, and Inclusion Concentration - both courses below:		
MGT 379	Bias in Individuals & Organizations [2]	3
MGT 381	Implementing & Evaluating Diversity, Equity, and Inclusion Programs [2]	3
Total Credits		**15**

MANAGEMENT CONSULTING

Required		
MGT/ENTP 306	Decision Making and Problem Solving in Business	3
MGT/SCM 328	Negotiations and Conflict Management	3
MGT 314	Business Consulting Practicum	3
Plus 2 from the following courses:		**6**
MGT 342	Managing in the International Organization [1]	3
MGT 346	International Business [1]	3
MGT 374	Societal Shifts	3
MGT 333	Human Resource Management	3
FIN 328	Corporate Financial Policy	3
MKT/ENTP 319	Innovation and Marketing of New Products	3
MGT 363	Managing Diversity and Inclusion in the Workplace	3
BIS 335	Application Development for Business	3
ENTP 304	Technology and Software Ventures	3
Total Credits		**15**

Entrepreneurship and Innovation

Required		
ENTP/MGT 201	Entrepreneurship & Enterprise	3
MGT/ENTP 302	Corporate Entrepreneurship and Innovation	3
ENTP/MGT 311	The Garage: Launching Entrepreneurial Ventures I	3
Plus 2 from the following courses:		**6**
MGT/SCM 328	Negotiations and Conflict Management	3
MGT 346	International Business [1]	3
ENTP/MGT 312	The Garage: Launching Entrepreneurial Ventures II	3
ENTP/MGT 306	Decision Making and Problem Solving in Business	3

ENTP/MKT 319	Innovation and Marketing of New Products	3
MGT 374	Societal Shifts	3
Total Credits		**15**

1

MGT 342 Management in the International Organization and MGT 346 International Business both fulfill the College of Business Global Requirement.

2

MGT 363 Diversity and Inclusion in the Workplace, MGT 379 Bias in Individuals & Organizations and MGT 381 Implementing & Evaluating Diversity, Equity, and Inclusion Programs fulfill the College of Business Diversity Requirement.

MANAGEMENT MINOR

This minor provides an overview of management program. It is designed to expose students to the field of management and to provide them with an opportunity to build and enhance their professional and leadership skills though a formal course of study. This minor is open available only to students with a declared major in the College of Business and/or students enrolled in either the IBE or CSB programs. College of Business students cannot receive overlapping credit between College of Business major and minor courses or overlapping credit between College of Business minor courses.

Program of Studies: The Management Minor consists of 3 courses equaling 9 credit hours from the following courses:

Select any 3 of the following courses (9 total credits):

MGT 328	Negotiations and Conflict Management	
MGT 333	Human Resource Management	
MGT 342	Managing in the International Organization	
MGT/GS 346	International Business	
MGT 363	Managing Diversity and Inclusion in the Workplace	
MGT 374	Societal Shifts	
MGT 379	Bias in Individuals & Organizations	
MGT 390	Global Business Immersion [1]	
Total Hours		**9**

[1]MGT 390 - Global Business Immersion is a variable credit course (0-3). To fulfill this program requirement with MGT 390, a student would need to register for the course as 3 credits.

Course descriptions for the College of Business graduate courses can be found under Business and Economics Graduate courses (p. 291).

Courses

MGT 043 Organizational Behavior 3 Credits
Managers are needed to make organizations run effectively. Management is the art and science of helping individuals achieve goals together, often in organizations. This course provides a broad overview of the principles of effective, ethical management at the individual, interpersonal, and group levels of analysis. Emphasis is on conceptual and applied organizational behavior topics such as: individual differences; decision making; perception and judgment; motivation; leadership; delivering effective feedback and performance appraisal; managing diversity; power, politics and influence; and organizational culture.

MGT 201 (ENTP 201) Entrepreneurship & Enterprise 3 Credits
This course provides an overview of the skills and steps needed to successfully launch new ventures. We will examine the entrepreneurial mindset and emphasize topics such as opportunity scanning, identification, and evaluation, informal networking, resource acquisition, business models, financing and debt, new venture strategies, developing a leadership team and a creative culture, managing change, ethics, franchising, and exit strategies. The course serves as a foundation for students who might own a business some day and/or work in a startup.
Prerequisites: ENTP 101 or MGT 043 or MGT 143

MGT 233 Managing the Health Care Workforce 3 Credits
Application of human resource management to the health care setting, with a focus on how the unique institutional aspects of the health care industry affect the recruitment, retention, and management of employees. Topics include, for example, managing conflict, burnout associated with long and unpredictable work hours, and coping with repeated exposure to trauma and stress.
Prerequisites: MGT 043

MGT 243 Leadership in Organizations 3 Credits
This course provides a deep dive into how to lead people, teams and organizations. Beyond intelligence and technical skills, what separates effective from less effective leaders is an understanding of the human side of business. This course offers an in-depth examination of leadership, and focuses on providing students with knowledge and abilities, increasing self-awareness, social-awareness, and organizational-awareness, thus facilitating their capacity for effective leadership. Students will learn to lead from within, and build and lead high impact and innovative teams.
Prerequisites: MGT 043

MGT 300 Apprentice Teaching 1-3 Credits

MGT 301 Strategic Management in a Global Environment 3 Credits
The capstone business class, integrating concepts and practices from core business classes, utilizing an organization-wide, strategic perspective and examining the relationship among firm strategy, structure and environment. Course emphasizes strategic analysis, strategy formulation, and strategy implementation to achieve sustainable competitive advantage. Corporate governance, corporate social responsibility and business ethics are incorporated into the strategic perspective. Case analyses and competitive simulation game are central learning components. Senior standing in the College of Business and completion of college core.
Prerequisites: (MKT 111) and (ECO 146 or ECO 119) and (LAW 201) and (FIN 125) and (MGT 186 or SCM 186) and MGT 043 and (MGT 143 or MGT 243 or CSB 312) and (BIS 111 or CSB 311) and ACCT 152 and (BUS 001 or BUS 002) and BUS 003 and BUS 203 and (BIS 244 or BUAN 244 or CSB 311)

MGT 302 (ENTP 302) Corporate Entrepreneurship and Innovation 3 Credits
This course explores the role of innovation in enterprise growth. Through assigned readings, cases, and group projects we explore the organizational and individual challenges associated with pursuing innovation as a driver of firm growth. The course also explores the tension between tradition and innovation as applicable to large family businesses including some of the most enduring ones (e.g., Ford, Dell, Walmart, BMW). The course uses a live case where students work with a real enterprise to develop a growth solution.
Prerequisites: ENTP 101 or MGT 043 or MGT 143

MGT 306 (ENTP 306) Decision Making and Problem Solving in Business 3 Credits
The course will provide the foundational hard and soft-skills consulting firms employ to identify and diagnose business problems, generate data, formulate innovative solutions, and effectively communicate recommendations. The course will blend lecture with experiential learning.

MGT 311 (ENTP 311) The Garage: Launching Entrepreneurial Ventures I 3 Credits
Students work in cross-disciplinary teams with faculty advisors and alumni mentors on marketing, financial planning, and economic and technical feasibility of entrepreneurial product- or service-based new ventures, commercial or non-profit. Students may elect to work either on their own entrepreneurial projects, on projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs. Oral presentations, written new venture plans and discussions with guest speakers are integral parts of the course. Consent of minor director.
Prerequisites: ENTP 101 or MGT 043 or MGT 143

MGT 312 (ENTP 312) The Garage: Launching Entrepreneurial Ventures II 3 Credits
Continuation of ENTP 311. Investigates and pursues in detail the critical steps and activities necessary when entrepreneurs seriously pursue launching new ventures.
Prerequisites: ENTP 311

MGT 314 Business Consulting Practicum 3 Credits
Students will build upon the skills acquired in MGT 306 and, working in student teams, will engage client organizations to diagnose and develop innovative solutions to address client needs.
Prerequisites: MGT 306
Attribute/Distribution: ND

MGT 328 (SCM 328) Negotiations and Conflict Management 3 Credits
This course covers the theory and processes of negotiation in a variety of settings including facetoface, virtual and crosscultural business environments. Students will learn negotiating skills by preparing and simulating a broad mixture of negotiations, ranging from oneonone, to threeperson, to multiparty and team negotiations. They will learn to analyze outcomes and strategies during the debriefing sessions and will have an opportunity to compare results of their negotiations to the results of other people in class.

MGT 333 Human Resource Management 3 Credits
Analysis and resolution of personnel problems in organizations. Human resource planning, recruitment, selection, orientation, training, appraisal, compensation, and development.
Prerequisites: MGT 043 or MGT 143

MGT 342 Managing in the International Organization 3 Credits
This course introduces students to the challenges of managing and leading organizations whose operations and activities span national boundaries. Particular attention will be given to the critical human resource issues confronting managers in the global marketplace. Topics discussed include: contemporary and emerging international organizational structures; fostering a global mindset; managing across cultures; developing global leaders; reward systems; performance management; and managing global careers. Junior standing is required.

MGT 346 (GS 346) International Business 3 Credits
This class provides an overview of international business, including the decisions, issues, and challenges faced by multinational enterprises and the environment in which they operate. This class will discuss why trade exists between nations and examine patterns in foreign direct investment. We will explore political, economic, cultural, and other differences between countries that are salient to international business. We will understand why businesses decide to create overseas subsidiaries, and the various choices available to them as they operate globally.

MGT 350 (BIS 350) Project Management 3 Credits
Key processes and tenets of project management including scope, time, cost, quality, human resources, communications, risk, procurement, and integration management. Both technical and behavioral aspects of project management are applied within the context of either IS management, HR management, Supply Chain Process Management, Small Business Management. Topics include: expectations management, change management and consulting engagement management. Introduces both software project monitoring tools and project team collaboration techniques and tools. Must have completion of all other courses in either BIS or Management major.
Prerequisites: (MGT 321 and MGT 333) or (MGT 321 and MGT 311 and MGT 306) or (MGT 321 and BIS 311 and BIS 324) or (MGT 321 and (SCM 328 or SCM 340 or SCM 342 or SCM 309 or SCM 354),)

MGT 363 Managing Diversity and Inclusion in the Workplace 3 Credits
This 3-credit course focuses on the complex dynamics that emerge in diverse groups and environments, explains how diversity and inclusion affect individual and organizational performance, relates diversity and inclusion to career development and success and to the management of human resources. This course also aims to develop skills and competencies for effectively managing diversity and its effects in the workplace. Diversity and Inclusion in the Workplace will be taught with a combination of lectures, self-assessments, class discussions, group exercises, self-reflections.

MGT 371 Directed Readings 1-3 Credits
Readings in various fields of management designed for the student who has a special interest in some field of management not covered by the regularly scheduled courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MGT 372 Special Topics 1-3 Credits
Special problems and issues in management for which no regularly scheduled course work exists. Consent of department chair required.
Repeat Status: Course may be repeated.

MGT 373 Management Internship 1-3 Credits
A sponsoring faculty member shall direct readings, projects, and other assignments including a comprehensive final report in conjunction with an industrysponsored internship. The work experience itself, whether paid or unpaid, is not the basis for academic credit. Intellectual development in the context of a field study learning experience will be the determining factor in awarding academic credit. This course cannot be used to satisfy requirements of the Management major. Consent of department chair required. Must have junior standing.

MGT 374 Societal Shifts 3 Credits
This course is designed to enable students to look at major societal-level forces and understand how they will impact society, and business, over the coming decades and what managers, can do to prepare the organization to thrive amidst the disruptive change that these forces will bring. This sequence will provide students with critical thinking skills to evaluate the current environment, predict how that environment is likely to shift in fundamental ways in the future, and help build adaptive resilient organizations.

MGT 379 Bias in Individuals & Organizations 3 Credits
Biased decision-making can threaten the ability for organizations to innovate, succeed, and lead in modern, multicultural societies. This course provides the tools to understand how bias can shape decision-making in individuals and organizations, and to critically evaluate strategies designed to reduce its pernicious impact. This course will equip students with a scientific understanding of how modern forms of bias operate in human relations and how to confront biases in individuals and organizations.

MGT 381 Implementing & Evaluating Diversity, Equity, and Inclusion Programs 3 Credits
This course focuses on the design, implementation, and evaluation of anti-bias interventions and other initiatives to create, maintain, and lead diverse, equitable, and inclusive (DEI) organizations. Students will learn and apply cutting edge scientific methods that are critical for evaluating the effectiveness of Diversity, Equity, Inclusion initiatives and anti-bias interventions. This course culminates in an independent research project in which students will propose, develop, and evaluate the effectiveness of an anti-bias or pro-diversity intervention in an organizational setting.
Prerequisites: MGT 379

MGT 390 Global Business Immersion 0-3 Credits
Participants have the opportunity to travel overseas and learn about business in a global setting. While abroad, students will interact with business owners, executives, government officials, and other key business stakeholders. The goal is to integrate global academic concepts learned in the classroom with the realities and functioning of business overseas. Eligibility restricted to students enrolled with the College of Business and related programs. Students are invited to participate by program leader(s) through application and interview process.

MGT 416 Managing Talent 3 Credits
The course is fundamentally about understanding and improving the behavior and performance of individuals in the workplace. As such, we will draw upon key theories in organizational behavior to address human resource issues arising from the employment relationship. Topics will address key areas in the talent pipeline from sourcing and selection, training and development, motivation and performance management, to talent management metrics and analytics.

MGT 431 Leadership in Contemporary Organizations 1.5 Credit
Leadership skill development for increasingly complex environments. This course covers concepts that will enable students to navigate their mutual interdependence in modern, complex, organizations. It focuses on personal leadership concepts (e.g., growth mindset; emotional intelligence), as well as relational leadership concepts (e.g., listening; giving and receiving feedback; coaching; how to have difficult conversations) and/or team leadership concepts.

MGT 436 Managing People 3 Credits
This course examines how effective organizations are created, maintained, and improved. The course will focus on how good people are attracted to an organization and how to make them productive. Topics include: organizational design, job design, staffing, training and development, performance, teams, influence, diversity, change, ethical decision-making, and current people issues facing today's organizations.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

MGT 438 Strategy for Competitive Advantage 3 Credits
The focus of this course is on how the organization creates and maintains competitive advantage in a rapidly shifting, complex environment. This course will give you the critical thinking skills to evaluate the current environment, predict how that environment is likely to shift in fundamental ways in the future, and build a resilient, adaptive strategy for your organization.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

MGT 439 Applied Capstone Experience (ACE) 1.5 Credit
The Applied Capstone Experience, or ACE, challenges students to grapple with a complex issue facing their organization. It builds on the functional topics and projects from other core courses, such that the ACE integrates different functional lenses in addressing a complex problem or opportunity that is critical to the organization. Students identify this substantive challenge facing the organization, work to understand its interconnectedness with the other operations of the organization, and seek to provide implementable strategic and operational solutions.
Prerequisites: ACCT 432 and FIN 433 and BIS 434 and SCM 435 and MGT 436 and MKT 437 and MGT 438
Can be taken Concurrently: ACCT 432, FIN 433, BIS 434, SCM 435, MGT 436, MKT 437, MGT 438

MGT 461 Strategic Management 1 Credit
Strategic Management covers overall organizational issues in determination, analysis, execution, and control within a global environment. This capstone course integrates theories and concepts from production, marketing, finance, and accounting and provides an opportunity to simulate the function of top level management as it relates to the total business environment through a team-based business simulation. Through readings, written assignments, presentations, in-depth group discussions, and a team-based simulation competition, students will broaden their understanding and practice the art of strategic decision making.

MGT 462 Experiential Learning Capstone 3 Credits
The Experiential Learning Capstone in the M2 curriculum immerses students in the study of how historical, iconic companies, under the guise of strategic management principles, created disruptive/game-changing industry innovation. Built on the foundational courses in the M2 curriculum, the capstone integrates classroom lectures with a combination of company visits and externship projects. Students apply their foundational learning in the study of how birth was given to a select set of companies.

Marketing

Department of Marketing Web page: www.lehigh.edu/cbemarketing (http://www.lehigh.edu/cbemarketing/)

Marketing is a critical success factor in any business. Marketing is more than just selling or advertising. It is understanding a product. It is focusing on the needs of the consumers. It encompasses new product development, pricing, promotion and distribution considerations. Marketing influences virtually all strategic business plans and decisions and its scope ranges from government and non-profit organizations to free enterprise. Marketing plays a major role in the management of any business.

Lehigh's marketing major is a rigorous and highly relevant curriculum of instruction. Students are taught to recognize the strong linkage between theory and practice and to appreciate the need for teamwork, leadership, and communication skills. Activities that encourage students to acquire professional-level competency throughout the curriculum include: developing integrated advertising campaigns, designing and implementing marketing research projects, conducting customer analyses, as well as a wide variety of practice-based projects.

Students are encouraged to explore the potential enhancement of their educational experience through study abroad programs, internships with businesses, and research projects with faculty members.

Participation in the Marketing Club enables students to explore the field of marketing through professional speaker events, field trips, and networking events. This student organization is an extracurricular activity and an affiliate chapter of the American Marketing Association (AMA).

MARKETING MAJOR
The marketing major offered by the Department of Marketing consists of 18 credit hours from the following courses:

Required courses		
MKT 311	Consumer Behavior	3

MKT 312	Marketing Research	3
MKT 387	Marketing Strategy	3
Elective courses		
Select three of the following:		9
MKT 313	Advertising & Sales Promotion Strategy	
MKT 314	Digital and Social Media	
MKT 319	Innovation and Marketing of New Products	
MKT 320	Global Marketing	
MKT 325	Consumer Insights through Data Analysis	
MKT 326	Marketing Analytics and Artificial Intelligence in the Digital Space	
MKT 327	Retail Marketing	
MKT 347	Strategic Brand Management	
MKT 330	Professional Selling	
MKT 332	Sales Management	
MKT 366	Services Marketing and Innovation	
MKT 371	Directed Readings	
MKT 372	Special Topics	
Total Credits		**18**

MARKETING MINOR

The purpose of the marketing minor program is to enable non-business students to pursue a course of marketing studies that will enable them to supplement their major studies and widen their career choices. The overall learning objective of the program is to provide non-business students with the knowledge and skills with which to make more informed marketing decisions.

Program of Studies:

A Marketing Minor consists of 12 credits. Students wishing to earn a Marketing Minor must take MKT 111, and then select three other marketing courses from the marketing curriculum.

Required Prerequisite Course:

ECO 001– Principles of Economics

GRADUATE COURSES

Course descriptions for the College of Business graduate courses can be found in this section under the heading of Business and Economics Graduate Courses.

Courses

MKT 111 Principles of Marketing 3 Credits
The purpose of this course is to give an overview of the entire marketing function. The objective is to take a broad-based approach to expose students to the meaning of marketing, the terminology of marketing, the activities involved in marketing, how managers make and implement decisions in marketing, and how they evaluate the results. The role of marketing in the broader society will also be discussed. At the end of this course, students will be able to understand the meaning of the marketing concept, various marketing terminologies, how firms develop and evaluate marketing strategies related to product, place, price, and promotions, how marketing strategies are related to other strategies of the firm, and what internal and external factors influence the marketing decisions. The outcome of the course will be assessed by a series of multiple choice and short essay questions, and other suitable assignments decided by the instructor.
Prerequisites: ECO 001

MKT 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

MKT 311 Consumer Behavior 3 Credits
This course focuses on the theory and tools necessary to analyze and understand consumer buyers and business buyers, as well as other organizational and governmental buyers, in the context of the global information age. The topics covered include, but are not limited to: market segmentation and product positioning; the multiattribute model and the theory of reasoned action; group and individual decision making processes of buyers; and buyer conditioning, perceptual, and learning processes.
Prerequisites: MKT 111

MKT 312 Marketing Research 3 Credits
The objective of this course is to offer a managerial approach toward conducting and using research for marketing decisions. The focus will be on the relevance and usefulness of systematic research for decision making, the process and steps involved in conducting effective marketing research, analysis and interpretation of the information for decision making, and the presentation of research results to help managers arrive at sound marketing decisions.
Prerequisites: ECO 045 and MKT 111

MKT 313 Advertising & Sales Promotion Strategy 3 Credits
The basic principles of advertising are covered in this course through the mechanism of an advertising campaign. Emphasis is on the advertising and promotions planning framework including but not limited to: targeting of advertising, types of media, types of promotions, media planning and buying, creative planning, and the basic creative formats appropriate for each medium. As part of a specific advertising campaign, the student must estimate the campaign's budget and evaluate the campaign's overall performance following its conclusion.
Prerequisites: MKT 111

MKT 314 Digital and Social Media 3 Credits
The focus of this course will be on understanding social and digital media, how to build social/digital media marketing strategies, and how to track their effectiveness. The key course objectives include: (1) evaluate what companies have done or are currently doing and learn what makes some marketing communications strategies succeed but others fail; (2) stay abreast of recent and current trends and innovations in social and digital media; and (3) learn about how customers interact socially.
Prerequisites: MKT 111

MKT 319 (ENTP 319) Innovation and Marketing of New Products 3 Credits
This course adopts the marketing philosophy that new products and services will be profitable if the extended product provides customers with highly valued benefits. The goal is to help students learn how to use state-of-the-art management techniques to identify markets, develop new product ideas, measure customer benefits, and design profitable new products. The course provides techniques to interface the marketing function with the functions of R&D, design engineering, and manufacturing.
Prerequisites: MKT 111

MKT 320 Global Marketing 3 Credits
Understanding the process of globalization and its impact on the firm’s marketing activities. Whether an organization operates in the domestic market or in the global market place, it cannot ignore competitive pressures and market opportunities at the global level. This course will focus on topics such as the changes in global environment and their impact on marketing activities, development of global marketing strategies based on sound marketing research, and the role of technology in global marketing strategies.
Prerequisites: MKT 111

MKT 325 (ECO 325) Consumer Insights through Data Analysis 3 Credits
Explores marketing analytic approaches aimed at improving the understanding of customers and customers' perceptions, thereby enhancing the effectiveness of marketing decision-making and implementation. Foundational data analysis techniques are examined in such areas as advertising, customer acquisition and retention (customer relationship management), segmentation, customer loyalty, lifetime-value analysis of the customer, pricing, sales force management, sales promotions, and new products. The development, implementation, and utilization of quantitative models on customer data are emphasized. Prerequisites as noted below.
Prerequisites: MKT 111 and ECO 146

MKT 326 Marketing Analytics and Artificial Intelligence in the Digital Space 3 Credits
Data analytics and artificial intelligence (A.I.) have become an essential toolkit for marketers. This course introduces the fundamental concepts and computational techniques for analyzing marketing data. Topics include structured/unstructured data, visualization, social media listening, SEO/SEM, and machine learning (M.L.). Students explore the impact of A.I. on various aspects of consumers' lives and companies' marketing actions. Through discussions, presentations, and hands-on exercises and projects, students will gain a solid understanding of analytics and A.I.- and M.L.-facilitated marketing in the digital space.
Prerequisites: MKT 111
Attribute/Distribution: ND

MKT 327 Retail Marketing 3 Credits
This course provides an overview of the retailing industry. Primary focus will be on the customer-facing activities of retailers, such as assortment planning, private-label development and the management of in-store operations, and the back-door activities that support customer interaction. In addition, current issues facing retailers, such as customer relationship management, industry consolidation and supplier relations, will be examined.
Prerequisites: MKT 111

MKT 330 Professional Selling 3 Credits
The course provides students with basic preparation for business-to-business personal selling and careers in sales. The course utilizes role-playing, experiential exercises, lectures and projects designed to teach the latest strategies and tactics in lead generation and prospecting, qualifying leads for high potentials, seeding, cold-calling, making formal sales presentations, handling objections, negotiating for final proposal, closing techniques and service after the sale.
Prerequisites: MKT 111

MKT 332 Sales Management 3 Credits
This course is an integrative approach to sales management including formulation of strategically sound sales programs, implementation of sales programs, and evaluation and control of the organization’s sales activities. Illustrative topics include the role of the sales manager in the divergent demands of multiple constituencies; the development of effective sales organizations; salesperson’s motivations and the development of flexible motivational plans; the variety of financial and non-financial rewards used by sales managers; forecasting sales costs and evaluating performance by person, territory, customer, market, and industry; and coordination of the sales activities with other elements in a firm’s marketing program.
Prerequisites: MKT 211 or MKT 111

MKT 347 Strategic Brand Management 3 Credits
In this class you will be introduced to concepts pertaining to brand development and its relationship with technology, design, emotions and the financial performance of firms. Our goal is to help you learn how to use state-of-the-art branding techniques. Our focus is brand equity and its contributions to shareholder wealth. The course will be relevant to students who expect to work directly in brand or product management.
Prerequisites: MKT 111

MKT 360 Marketing Practicum 3 Credits
The marketing practicum combines formal class work on marketing problem formulation and business communications with an intensive internship or consulting engagement with a business. Students work with client firms to develop individual or team projects, which focus on marketing activities such as market research, strategy development, sales management, and promotion management. Upon completion of the project, students submit a written report and make a formal presentation to clients. This course cannot be used to satisfy marketing major requirements. Summer only.
Prerequisites: MKT 111 and MKT 312 and MKT 311

MKT 366 (ENTP 366) Services Marketing and Innovation 3 Credits
While manufacturing giants all consider themselves service-related companies, services are moving to the forefront of industry value proposition offerings. This course focuses on issues related to service design and marketing on a broad basis, and its implication to retailing in particular. The course enables students to gain an understanding of the special challenges evident in marketing services and to acquire a unique set of knowledge and skills beyond the traditional strategies designed for product goods. Illustrative topics include fundamental differences.
Prerequisites: MKT 111

MKT 371 Directed Readings 1-3 Credits
Readings in various fields of marketing designed for the student who has a special interest in some field of marketing not covered in regularly scheduled courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MKT 372 Special Topics 1-3 Credits
Special problems and issues in marketing for which no regularly scheduled course work exists. When offered as group study or internship, coverage will vary according to the interests of the instructor and students. Consent of department chair required.
Repeat Status: Course may be repeated.

MKT 373 Marketing Internship 1 Credit
Based on a student’s work experience, a sponsoring faculty member shall direct readings, projects, and other assignments–including a “capstone report.” It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail and cannot be used to satisfy marketing major requirements. Must have junior standing. Consent of department chair required. Declaration of a marketing major.
Repeat Status: Course may be repeated.
Prerequisites: MKT 111

MKT 387 Marketing Strategy 3 Credits
The objective of this capstone course is to synthesize the marketing principles introduced in other marketing courses and thus provide students an integrative framework to marketing decision-making. Our review indicates that this integrative closure for the marketing coursework is a common practice at some of the better business schools. It will focus on how marketing strategy supports the overall corporate strategy. The course will emphasize that Marketing does not operate in vacuum. What is done in other functional areas will impact marketing strategy profoundly, and vice versa. The will address traditional strategic issues such as identification of organizational strengths, weaknesses and environmental opportunities in the context of developing marketing strategies, but will also emphasize the importance of embracing a customer centric orientation throughout the organization. Incorporating a customer centric orientation is an essential component of marketing strategy today as it captures the dynamic and evolving nature of marketing. Every company employee is important to the marketing function, every employee contact with a customer is a form of marketing communication, the increasing number of customer- initiated contacts with the firm are as important as firm-initiated contacts, and customer relationships now take precedence over sales transactions. Specific emphasis will be placed on applying theoretical principles in realistic scenarios by means of case studies of how marketing strategy is impacted by the overall corporate strategy and other functional strategies. Student performance will be evaluated by his/her ability to prepare and present case analyses. Senior Standing.
Prerequisites: MKT 311 and MKT 312

MKT 389 Honors Project 1-6 Credits

MKT 415 Marketing Foundations 3 Credits
This course is designed to provide students with a comprehensive analytical framework to develop, implement and evaluate competitive marketing strategies that achieve organizational goals and objectives. It explores the functional marketing operations of organizations and examines the key elements of a marketing manager's decision making process. Examples of learning modules include: customer and market analysis, segmentation, targeting and positioning, marketing mix decisions (product, price, placement and promotion).

MKT 425 Contemporary Topics in Marketing 2 Credits
The objective of this course is to build on the principles learned in Marketing Foundations and study a series of contemporary topics relevant for the marketing function in organizations. The focus is on key factors that are driving changes in the marketplace and the implications to the organization when devising strategies. Students will obtain an understanding of how to identify emerging trends, explore the underlying antecedents and consequences of these trends, and learn how organizations can proactively manage these trends.
Prerequisites: MKT 415

MKT 437 Customer Insights and Marketing Strategy for Managers 3 Credits
This course presents principles, tools, and techniques to understand customers and the marketplace that enable marketers to create, communicate, and deliver superior value to all stakeholders. Select topics include segmenting and targeting prospective customers, assessing competitors, positioning offerings, managing customer relationships, and creating lifetime value. Building on the fundamentals, more advanced conceptual frameworks, analytical tools, and contemporary perspectives for managerial decision-making will be applied to effectively develop and manage new and existing customer offerings in the increasingly data-rich environment.
Prerequisites: MGT 431
Can be taken Concurrently: MGT 431

Real Estate

Real Estate is, by far, the most significant store of global wealth; and most people spend the majority of their lives in the built environment. Closer to home, real estate related businesses typically generate over 25% of U.S. economic activity. Consequently, real estate presents a wide array of career opportunities in areas including (but not limited to) accounting, banking, brokerage, construction, consulting, design, development, engineering, finance, government, insurance, investment, law, management, marketing, planning, and valuation. The Real Estate Minor is, therefore, designed to complement a wide range of majors. Students must take five courses comprised of both required and elective components which draw from several academic disciplines across campus. The program is housed in the Goodman Center for Real Estate and open to undergraduate students of all majors.

REAL ESTATE MINOR
Students must take five courses comprised of both required and elective components that draw from several academic disciplines across campus, including completing a minimum of nine unique real estate credit hours. Therefore, students may not double count more than two courses towards the fulfillment of their major and real estate minor requirements. The program is housed in the Goodman Center for Real Estate and open to undergraduate students of all majors.

Required Courses		
REAL 301	Real Estate Development	3
REAL 347	Real Estate Investment	3
REAL 348	Real Estate Practicum	3
Elective Courses		
Choose Two of the Following		6-8
REAL 305	Real Estate Law	
FIN 336	Real Estate Finance	
MGT/SCM 328	Negotiations and Conflict Management	
POLS/EVST 312	Urban Environmental Policy Workshop	
CEE 266	Construction Management	
ARCH 002	History of Architecture	
or ARCH 034	Digital Drawing and 3D Modeling	
or ARCH 157	Architectural Technology I	
Total Credits		**15-17**

Courses

REAL 082 Guest Speaker Seminar Series 1 Credit
This course is designed to provide students with exposure to the real estate industry and the opportunity to network with successful professionals in the field. Through visiting speakers, students will learn about topics of fundamental importance and draw connections to the various careers associated with them. The course is open to all undergraduate students.
Repeat Status: Course may be repeated.

REAL 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

REAL 301 Real Estate Development 3 Credits
This course examines "ground-up" real estate development as well as re-hab/re-development across various property types (office, retail, industrial/warehousing, multi-family, mixed use, hospitality, etc.) Emphasis is on concise analysis and decision making. The main topics covered may include the following: the development process, market analysis, site selection, due diligence, zoning, entitlements/ approvals, site planning, building design, and the similarities and differences of traditional real estate product types.

REAL 302 Real Estate Internship 1 Credit
Students are not required to obtain academic credit for an internship. However, if academic credit is desired, or made a condition of employment by an employer, students may register for REAL 302. The work experience itself is not the basis for academic credit. Course registration and related arrangements must be made in advance of the work experience. This course must be taken Pass/Fail and cannot be used to satisfy minor requirements. Consent of program director/ manager required.
Repeat Status: Course may be repeated.

REAL 305 Real Estate Law 3 Credits
An examination of real estate investment, finance, and development from a legal perspective in a transactional setting. The course will be of interest to students contemplating careers in accounting, real estate brokerage, real estate investment, real estate finance, real estate development, city planning, or banking. The main topics covered may include the following: land acquisition, finance; choice of entity; tax aspects; management (leasing, environmental); disposition of real property (sale of mortgaged property, foreclosures, sale-leasebacks); and recent legal developments.

REAL 347 Real Estate Investment 3 Credits
An exploration of real estate investment value from the perspective of the equity investor in existing commercial real estate assets. The main topics covered may include the following: drivers of value, modeling in spreadsheets and specialized software applications, taxation, investment structuring, asset management, and sources of equity capital.

REAL 348 Real Estate Practicum 3 Credits
This capstone course provides a deep dive into the valuation of a "real world" asset. Students are formed into teams and conduct an in-depth market analysis including rents, vacancy rates, and absorption rates; and, a refined financial analysis of the subject property including historical results and pro forma estimates of revenues, expenses, cash flow and residual value. Each team also studies the financial characteristics of comparable properties. Note: This course cannot be taken concurrently with REAL 346 and/or REAL 347.
Prerequisites: REAL 301 and REAL 347

REAL 371 Directed Readings 1-3 Credits
Readings in various fields of real estate designed for the student with a special interest in some field of real estate not covered in scheduled courses. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

Supply Chain Management

Success in today's business environment is driven by competitive advantage and profitability. Customer-focus, value added product differentiation and cost management are the elements associated with industry leaders. The Supply Chain Management undergraduate major at Lehigh University, housed in the Department of Decision and Technology Analytics (DATA), prepares students to understand and manage the processes that distinguish the successful company from its competitors.

The Supply Chain Management major equips students with the knowledge, skills and abilities necessary for success in the complex business environment of the 21st Century. This program:

- Provides solid exposure to supply management, logistics, business-to-business, and operations management topics.
- Emphasizes advanced cost analysis, quality and financial management and improvement, logistics network modeling, risk management, analytical tools, and enterprise techonologies that support supply chain operations, as well as buyer-supplier negotiation.
- Integrates core business courses with supply chain major courses.
- Provides field study and experiential learning opportunities.

Supply Chain Management graduates will be prepared to enter industry at a level that accelerates their on-the-job learning and development. Supply Chain Management graduates typically work within five areas, each with its own set of positions and career paths:

- procurement and supply management
- transportation and logistics
- operations management
- inventory management and control
- supply chain planning

SUPPLY CHAIN MANAGEMENT PROGRAM

Lehigh's undergraduate major and minor in supply chain management equips students with the knowledge, skills and abilities necessary for success in today's complex business environment.

This innovative program provides solid exposure to supply management, logistics, cost and risk management, demand and supply chain planning, e-business enterprise planning, supply chain analytics, transportation management and operations management topics. The supply chain program has an increased emphases on analytical tools, advanced cost analysis, negotiation, product development, and e-business; integrates core business courses with supply chain major courses; and provides field study and experiential learning opportunities.

Required Major Courses

SCM 309	Supply, Cost, and Risk Managment	3
SCM 330	Analytics for Service Operations	3
SCM 340	Demand and Supply Chain Planning	3
BIS/SCM 342	e-Business Enterprise Applications	3
SCM 345	Analytical Approaches to Supply Chain Management	3
SCM 354	Integrated Logistics and Transportation Management	3
Total Credits		**18**

SUPPLY CHAIN MANAGEMENT MINOR

The Supply Chain Management minor is designed to offer students in other disciplines an opportunity to learn about supply chain topics and issues. The College of Business offers a Supply Chain Management minor to any student that has completed the following:

The Supply Chain Management minor is designed to offer students an opportunity to learn about supply chain topics and issues. The minor is available to all undergraduate students in all colleges. Some courses that apply to the minor have prerequisites. These prerequisites do not count toward the minor, and students attempting to complete the minor are not recused from these prerequisites. Students must complete all courses for the minor with a grade point average of 2.0 or higher. The Supply Chain Management minor consists of the following:

Required

SCM 354	Integrated Logistics and Transportation Management	3
Select two of the following:		6
SCM 309	Supply, Cost, and Risk Managment	
SCM 330	Analytics for Service Operations	
SCM 342	e-Business Enterprise Applications	
SCM 340	Demand and Supply Chain Planning	
SCM 345	Analytical Approaches to Supply Chain Management	
Total Credits		**9**

Courses

SCM 186 Supply Chain Operations Management 3 Credits
Introduction to managing global supply chains and operations within the context of an integrated value chain. Topics include supply chain management, total quality management, project management, demand forecasting, supply management, lean operations, aggregate planning, capacity planning, inventory management, distribution and transportation management, and performance measurement.
Prerequisites: (MATH 021 or MATH 076 or MATH 097 or MATH 081) and (ECO 045 or ECO 145 or MATH 231 or ISE 121)
Attribute/Distribution: ND

SCM 240 Health Care Operations Management 3 Credits
The healthcare industry faces many unique operational challenges. Managing tradeoffs between cost, quality, and access is not only important to individual care organizations, it has become a national priority. This course will focus on how operational decisions influence these tradeoffs and the organizational drivers that yield positive patient experiences. We will examine the roles of people, systems, and technology in matching capacity and demand as well as performance measurement.
Prerequisites: SCM 186 and BUAN 044

SCM 300 Apprentice Teaching 1-4 Credits
(No catalog description exists for this course).

SCM 309 Supply, Cost, and Risk Managment 3 Credits
This class presents a framework for achieving sustainable competitive advantage through progressive supply management leadership and approaches. It presents the need for supply leadership, the organizational enablers that must be in place, and the strategies and approaches that leading organizations pursue to achieve competitive advantage in price and cost, quality, delivery, cycle time, technology, flexibility, and end customer responsiveness. Special attention is given to a wide range of price, cost and risk management techniques.
Prerequisites: SCM 186 or MGT 186

SCM 328 (MGT 328) Negotiations and Conflict Management 3 Credits
This course covers the theory and processes of negotiation in a variety of settings including face-to-face, virtual and cross-cultural business environments. Students will learn negotiating skills by preparing and simulating a broad mixture of negotiations, ranging from one-on-one, to three-person, to multiparty and team negotiations. They will learn to analyze outcomes and strategies during the debriefing sessions and will have an opportunity to compare results of their negotiations to the results of other people in class.

SCM 330 Analytics for Service Operations 3 Credits
Students learn to transmute data into decisions through a curated portfolio of real-world cases. The course explores elements that unite services and those that differentiate service processes from non-service processes. Key analytical tools from statistical modeling to queueing theory are introduced through hands-on data-analysis using appropriate programming language. Cases illustrate how analytical models can help assess service operations, redesign service processes, and establish systems that ensure an excellent customer experience. Assignments emphasize business communication skills deemed critical by employers.
Prerequisites: SCM 186 and (BIS 044 or BUAN 044)

SCM 340 Demand and Supply Chain Planning 3 Credits
Students will learn how businesses work with other businesses to build relationships and integrate demand and supply planning activities across the supply chain to deliver value to customers. They will learn about tools and technologies enabling integration, and the critical drivers and key metrics of supply chain performance. Current readings, case studies, simulations and written assignments will be used.
Prerequisites: MGT 186 or SCM 186

SCM 342 (BIS 342) e-Business Enterprise Applications 3 Credits
Introduction to the implications of key information technologies used within and across businesses to conduct e-business. The course covers the functionality of various enterprise applications and their integration: customer relationship management, enterprise resource planning, supply chain management, supplier relationship management, data warehousing and mining, business intelligence, and product lifecycle management.
Prerequisites: BIS 111

SCM 345 Analytical Approaches to Supply Chain Management 3 Credits
This class presents and requires the application of various tools and techniques that support an analytic approach to supply chain analysis and decision making. In particular, tools and techniques related to quality management, lean, constraint analysis, inventory management, new product development, process design, statistical analysis, predictive analytics, and supply chain optimization are emphasized. The class features lectures, exams, case analyses, projects, and problem sets.
Prerequisites: SCM 186 and BIS 111

SCM 354 Integrated Logistics and Transportation Management 3 Credits
A combined lecture, discussion, and experiential course designed to provide students (1) exposure to the fundamentals of logistics and transportation and (2) the opportunity to work in teams to manage a company's supply chain within a strategic supply chain simulation. Students will gain hands-on-experience integrating supply chain management concepts to optimize business performance outcomes. Topics addressed include integrated logistics, transportation, warehouse management and global logistics.

SCM 371 Directed Readings 1-3 Credits
Readings in various fields of supply chain management designed for the student who has a special interest in some field of supply chain management not covered by the regularly scheduled courses. Consent of the department chair.
Repeat Status: Course may be repeated.

SCM 372 Special Topics 1-3 Credits
Special problems and issues in supply chain management for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of instructor and students. Consent of the department chair.
Repeat Status: Course may be repeated.

SCM 373 Supply Chain Management Internship 1-3 Credits
A sponsoring faculty member shall direct readings, projects and other assignments including a comprehensive final report in conjunction with an industry sponsored internship. The work experience itself, whether paid or unpaid, is not the basis for academic credit. Intellectual development in the context of a field study learning experience comparable to BUS 211 (ENGR 211), Integrated Product Development Projects, and SCM 372, Special Topics, will be the determining factor in awarding academic credit. This course cannot be used to satisfy requirements of the Supply Chain Management major. Consent of the department chair. Must have junior standing in the College of Business and Supply Chain Management declaration.
Repeat Status: Course may be repeated.

SCM 423 Supply Chain Operations Management 2 Credits
This course provides an essential understanding of managing global supply chains and operations within the context of an integrated value chain. Topics addressed include the fundamentals of supply chain management; supply chain risk management; quality management; demand and supply chain planning, including forecasting, capacity planning, aggregate planning, and scheduling; the components of a lean supply chain; inventory and working capital management; distribution and transportation management; and performance measurement. Special emphasis is given to managing supply chains from a financial perspective.

SCM 435 Operations and Supply Chain Management 3 Credits
This course provides students with an overview of supply chains, operations of organizations within the supply chain and the impact of their designs on organizational competitive strategies. It provides basic techniques organizations use when operating within modern supply chains and reviews key decision tools such as demand planning, capacity management and processes improvement.
Prerequisites: (ECO 045 or BUEC) and MGT 431
Can be taken Concurrently: MGT 431

College of Education

The university's College of Education offers opportunities for advanced study in the field of education.

Graduate Degrees in Education

Lehigh's College of Education (https://ed.lehigh.edu/) offers primarily graduate degree programs.

Financial assistance. Graduate and research assistantships are available in the college and in various administrative offices on campus. In addition, graduate students may be recommended for a limited number of fellowships and endowed scholarships that are awarded by the college.

Lehigh's Centennial School, a laboratory school for children with emotional/behavior disorders, provides employment for some Lehigh education students. Graduate students may apply for teaching internships, which cover tuition and offer a salary.

Lehigh University Autism Services (LUAS) provides intervention to young autistic children and their families. Paid positions are available. In addition, supervised fieldwork, required for BCBA certification, is provided through LUAS.

Master of Education (M.Ed.)

This degree is offered in the following professional specializations: behavior analysis; elementary education, globalization and educational change, secondary education, special education, educational leadership, instructional technology, international school counseling, mental health counseling, school counseling, and teaching and learning. Degree requirements vary from program to program. **Please note**: the College of Education is no longer accepting applications for the globalization and educational change program.

Master of Arts (M.A.)

The master of arts is available in comparative and international education. This M.A. examines educational policy and theory on an international level, preparing its graduates to work in educational research and policy organizations, government offices, ministries of education, and international development organizations. Please note: The College of Education is no longer accepting applications for the M.A. in comparative and international education.

Master of Science (M.S.)

The master of science degree is awarded in instructional technology. The M.S. in instructional technology focuses on the planning and use of instructional technology in preK-12 and post secondary settings and non-formal learning environments (such as museums and science centers). The program is targeted toward individuals from varied backgrounds who wish to support educators or learn themselves to design, develop, and incorporate technology applications more effectively in diverse educational settings.. This degree is ideal for those who teach in the classroom and online, technology specialists, informal educators, and others interested in effectively using information and communication technologies to enhance instruction. The program is designed to develop skills that can be used to create new curriculum and learning activities to meet the demands of a changing technological society and the needs of new generations of students. As such, graduates may be designing online courses, enhancing existing curriculum with emerging technologies, or working as technology specialists, assisting with the integration of technology in academic and informal learning environments. The instructional technology graduate program is intended for both current professionals in the education field as well as those who are seeking an advanced degree to enhance their skills and knowledge base related to technology.

Master in Business Administration/Master of Education (MBA/M.Ed.)

The MBA and master's of education joint degree program offers students the opportunity to acquire a solid foundation in both business and education. Designed to increase the administrative skill required in today's educational systems, the MBA/M.Ed. provides a framework in which excellent education and sound business practices can flourish. The MBA/M.Ed. will provide an additional option for students for business and students of educational leadership. The program should enhance the student's marketability in private and public sector education while providing students with an understanding of the cultures of both business and education. Please note: The College of Education is no longer accepting applications for the MBA/M.ED. program.

Educational Specialist (Ed.S.)

A specialized post-master's degree program is available in school psychology. The Education Specialist, or Ed.S., is an advanced academic degree designed for individuals who wish to develop additional skills or increase their knowledge beyond the master's degree level, but may not wish to pursue a degree at the doctoral level.

Certification Programs

The College offers programs of study leading to eligibility for Pennsylvania state certifications in various professional specialties including elementary and secondary teacher education, special education; supervisor of curriculum and instruction; superintendent; K-12 principal; and ESL program specialist. Certification programs vary in the number of credits required.

Post-Baccalaureate Certificates

The college also offers post-baccalaureate certificate programs (http://ed.lehigh.edu/academics/certificates/) in a number of different areas, including international school counseling, behavior analysis; learning design in educational and professional settings; social, emotional, behavioral wellness; teaching English as a second language; game-based learning, college admissions counseling, and mental health and education of Latin American people in the US. Lehigh's post-baccalaureate certificate programs are focused concentrations of 12 to 18 credits that students complete to enhance their professional credentials. Where appropriate, post-baccalaureate certificate programs may be included as part of the coursework of a degree program. Post-baccalaureate certificate programs differ from the above-described certifications issued by agencies external to Lehigh (such as the Pennsylvania Department of Education).

Doctor of Philosophy (Ph.D.)

The College of Education also offers the Ph.D. degree in comparative and international education, counseling psychology, school psychology, special education, and teaching, learning and technology. The requirements for this degree are the same as those for the Ph.D. in the other colleges and as described in previous sections. Please note: The College of Education is no longer accepting applications for the Ph.D. in comparative and international education.

Doctor of Education (Ed.D.)

The doctor of education degree program provides specialized study in educational leadership. Successful professional experience is required for admission to candidacy. The requirements for the Ed.D. degree parallel those already stated for the Ph.D. degree.

Non-Degree Options

Non-degree options are designed for those individuals interested in taking courses in the College but not interested in pursuing a graduate degree. For information on the non-degree program, email coe-admissions@lehigh.edu. There are two non-degree options as well:

1. Regular non-degree and
2. Non-degree for external certification.

Regular non-degree admission is for students who wish to take up to 12 credits of graduate coursework at Lehigh University without seeking a degree. Any transcript or other record from the University will clearly indicate the student status as non-degree. Non-degree students are not permitted to audit courses. University admissions criteria for non-degree graduate students are (a) a bachelor's degree from an accredited institution with an overall grade point average of at least 2.75 on a four-point scale or (b) to have achieved a GPA of 3.0 or higher on a four-point scale for a minimum of 12 graduate credits at another accredited institution.

Non-degree for external certification students are admitted to pursue coursework for the purpose of obtaining certification through an external accrediting agency. Applicants are expected to have an undergraduate GPA of 3.0 or higher on a four-point scale or to have achieved a GPA of 3.0 or higher on a four-point scale for a minimum of 12 graduate credits at another accredited institution. Applicants are assigned certification advisers on admissions and must work with the adviser to assure that they complete all requirements for

certification satisfactorily. Students complete the coursework and any other required field experiences for the appropriate certification, with the number of credits and field experiences being dictated by the external accrediting agency. Thus, the number of credits will vary and will typically exceed the 12 credit limit for regular non-degree students. A non-degree student seeking such certification must meet the quality standards of the certification program, as well as completing the necessary coursework and field experiences.

Changing from Non-Degree to Degree Status

Non-degree students of either type may seek admission to a degree program. Non-degree students who seek admission to a degree program must meet all regular admissions criteria, complete all regular application procedures, and present all documents normally required of degree-seeking applicants to that program. Courses taken by a non-degree student who later enters a degree program will count towards the completion of the program to the extent that those courses fall within the normal requirements of the program and to the extent that the student's performance in the course(s) is acceptable for degree program purposes. Any course that is counted towards the completion of a degree must be completed within the established time limits for that degree, whether taken initially as a degree or non-degree course.

Non-degree students may seek admission to a degree program. Non-degree students who seek admission to a degree program must meet all regular admissions criteria, complete all regular application procedures, and present all documents normally required of degree-seeking applicants to that program. Courses taken by a non-degree student who later enters a degree program will count towards the completion of the program to the extent that those courses fall within the normal requirements of the program and to the extent that the student's performance in the course(s) is acceptable for degree program purposes. Any course that is counted towards the completion of a degree must be completed within the established time limits for that degree, whether taken initially as a degree or non-degree course.

4+1 Accelerated Master's Programs

Undergraduates may apply to the college's 4+1 Accelerated Master's Programs. (https://ed.lehigh.edu/academics/department-education-human-services-programs/coe-41-accelerated-programs/) The 4+1 programs are designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six years. Undergraduate students may also pursue a minor in education (https://ed.lehigh.edu/academics/programs/teacher-education/). The Education minor allows upper level undergraduates to take selected coursework that combines practical activities with theoretical work and is designed to provide a foundation for further studies at the graduate level. Students enrolled in courses in the College of Education should check with their advisers for a list of regulations and requirements governing degree programs.

Comparative and International Education

Starting in 2017, the CIE program is no longer accepting new applications.

The Comparative and International Education (CIE) Program offered three degrees: An M.Ed. in Globalization and Educational Change, a M.A. in Comparative and International Education, and a Ph.D. in Comparative and International Education. The CIE program also offered a Lehigh graduate certificate program in International Education for Development.

Graduates completing their degree in the CIE program may move into positions in international education, as government officials and education policy makers, research/policy institute scientists, development program officers, or work in various non-governmental and educational organizations either in the United States or in countries around the world.

The Comparative and International Education (CIE) program provided a unique blend of global community, content, interaction, context, perspective and purpose. Highlights of these innovative qualities include:

- An international learning community. The CIE Program was a vibrant learning community where internationalization thrived in formal classroom instruction, as well as in daily socialization of students and faculty in academic, professional, and personal realms. CIE students had a unique opportunity to engage in a myriad of international experiences as a part of their graduate education experience, including conducting education research and evaluation worldwide, engaging in international education development consultancy, internships at the United Nations, and assisting in journal/book editing in comparative and international education.
- Multiple opportunities for student/faculty interaction. CIE faculty brought extensive experience in the field as teachers and leaders, as well as a theoretical and methodological grounding in a discipline, which is relevant to global research and comparative educational issues. We recognize that students bring a wealth of expertise and knowledge that complements the faculty's expertise and knowledge. Therefore, the CIE program provided a framework through which students and faculty could build professional relationships that extend beyond the classroom, including collaborative projects, directed study, and intellectual discourse.
- Interdisciplinary perspectives. Given that education is the product of many converging forces from politics to society to economics to history to business and philosophy, education and schooling issues are too complex and diverse to be addressed by just one disciplinary perspective. Unless we understand the various factors impacting decisions, we cannot understand why schools in countries around the world are structured the way they are, or why educational policies in our own communities deal with the topics they do. Working closely with the graduate programs in the College of Education and across the university, the CIE degree programs breached the boundaries of disciplines, thus creating an opportunity for its graduates to examine education-related issues from multiple perspectives.

There were several projects that exemplified the CIE Program's signature and distinctive properties. They were,

- International Education and Research. CIE faculty and students participated in research and academic exchange with colleagues around the world. One example is through the CIE Program-based Tübingen-Lehigh International Partnership (TüLIP). Through TüLIP, Lehigh students had the option to take either full-term or short schedule courses taught in English at the University of Tübingen (Germany). Research or field-work could also be taken for Lehigh academic credit and was collaboratively supervised by both Lehigh and Tübingen professors. One recent project connected to TüLIP through the CIE Program was the Mountaintop Experience called "Transitions for Refugees through Empowerment and Education" (TREE). The TREE project united Lehigh students, refugee advocates and education experts in both the U.S. and Germany to investigate the dynamic factors facing resettled refugee youth.
- Scholarly Publication and Editing. The CIE Program was home to two professional academic publications in the field: The Annual Review of Comparative and International Education (ARCIE) and the FIRE: Forum for International Research in Education. ARCIE is the flagship academic review in the field of comparative and international education, and is published annually. FIRE is an international, peer-reviewed, open-source, online journal promoting interdisciplinary scholarship on the use of internationally comparative data for evidence-based and innovative change in education worldwide. CIE faculty served as senior editor for both publications and CIE students served as both editorial assistants and frequent co-authors for these prestigious publications.
- International Development and Consulting. CIE Program faculty and students engaged in short-term development and program-related consultancy projects on a regular basis. For example, a CIE faculty and student team worked with a youth village for orphaned and vulnerable youth in post-genocide Rwanda to develop a village-wide monitoring and evaluation system. This consultancy project, developed with the support of a CIE degree program graduate working with the Rwandan village, involved both Lehigh-based and Rwanda-based planning, research, workshops,

and other consultancy-related activities, and complemented graduate-level coursework in the CIE program.

Doctor of Philosophy in Comparative and International Education

The Ph.D. degree program in Comparative and International Education (Ph.D. CIE) prepares students for research, scholarly inquiry, and advanced professional careers in the field of comparative and international education. A hallmark of this program is the bridge between educational theory, research, and practice. The Ph.D. degree program is practical, research-oriented, and policy-focused, while adding a robust theory-oriented and research-driven component.

The Ph.D. in CIE degree offers a combination of rigorous training in comparative education; key skills in policy analysis, monitoring and evaluation and advocacy; as well as provides students with the flexibility to pursue in-depth research in a variety of areas critical to comparative and international education. Graduates are prepared to work in higher education institutions, educational research and policy organizations, government offices, ministries of education, and international development organizations.

Comparative & International Education Core (15 credits)		
CIE 400	Course CIE 400 Not Found	3
CIE 401	Course CIE 401 Not Found	3
CIE 471	Course CIE 471 Not Found	3
CIE 450	Course CIE 450 Not Found	3
CIE 451	Course CIE 451 Not Found	3
Research Methods Core (21 credits)		
CIE 410	Course CIE 410 Not Found	3
CIE 411	Course CIE 411 Not Found	3
CIE 460	Course CIE 460 Not Found	3
CIE 402	Course CIE 402 Not Found	3
EDUC 405	Qualitative Research Methods	3
EDUC 410	Univariate Statistical Models	3
EDUC 411	Multivariate Statistical Models	3
Interdisciplinary Core (27 credits)		
CIE 404	Course CIE 404 Not Found	3
CIE 406	Course CIE 406 Not Found	3
In addition, students are required to complete at least 21 credits across three interdisciplinary program areas with at least two courses in each of the interdisciplinary areas. This includes one CIE required course in each area and electives depending on students' research needs and interests: 1) Society and Culture, 2) Politics and Policy, and 3) Sustainable Development.		
CIE 405	Course CIE 405 Not Found	3
CIE 412	Course CIE 412 Not Found	3
CIE 414	Course CIE 414 Not Found	3
Other elective courses in sociology, anthropology, political science, environmental initiative, and other programs with the approval of CIE and relevant program faculty.		
In addition to courswork, the Ph.D. program in Comparative and International Education requires successful completion of both the doctoral qualifying project and the comprehensive examination. Students then must complete the dissertation proposal seminar.		
CIE 470	Course CIE 470 Not Found	3
Concentrated Learning Requirement: All students must complete a concentrated learning requirement in accordance with COE rules and regulations. The concentrated learning requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. In order to fulfill this requirement, students must be accepted into the doctoral program.		
CIE 408	Course CIE 408 Not Found	3

Master of Arts In Comparative and International Education

CIE 400	Course CIE 400 Not Found (REQUIRED COURSES (15 CREDITS))	3
CIE 401	Course CIE 401 Not Found	3
CIE 408	Course CIE 408 Not Found	3
EDUC 471	Diversity and Multicultural Perspectives	3
EDUC 403	Research	3
EDUC 408	Introduction to Statistics	3
ELECTIVE COURSES (6 CREDITS, select 2 courses from below)		
CIE 402	Course CIE 402 Not Found	3
CIE 403	Course CIE 403 Not Found	3
CIE 404	Course CIE 404 Not Found	3
CIE 405	Course CIE 405 Not Found	3
CIE 406	Course CIE 406 Not Found	3
CIE 407	Course CIE 407 Not Found	3
SELECT A DISCIPLINARY FOCUS:		
Focus 1: SOCIOLOGY & ANTHROPOLOGY (12 CREDITS, select 4 courses from below)		
ANTH 325	Economic Anthropology	4
AAS 313	Course AAS 313 Not Found	4
GS 322	Global Health Issues	4
SOC 323	Course SOC 323 Not Found	4
SOC 329	Course SOC 329 Not Found	4
SOC 341	Course SOC 341 Not Found	4
SOC 345	Course SOC 345 Not Found	4
SOC 351	Course SOC 351 Not Found	4
SOC 355	Sociology Of Education	4
SOC 364	Sociology of Families	3,4
SOC 402	Course SOC 402 Not Found	3
SOC 415	Course SOC 415 Not Found	3
SOC 418	Course SOC 418 Not Found	3
SOC 419	Course SOC 419 Not Found	3
SOC 420	Course SOC 420 Not Found	3
SOC 441	Course SOC 441 Not Found	3
SOC 454	Course SOC 454 Not Found	1-4
SOC 465	Course SOC 465 Not Found	3
SOC 473	Course SOC 473 Not Found	3
SOC 476	Course SOC 476 Not Found	3
OTHER SSP 400+ AND ANTH 400+ courses with advisor approval		
Focus 2: POLITICAL SCIENCE & INTERNATIONAL RELATIONS (12 CREDITS, select 4 courses from below)		
POLS 413	Modern Political Philosophy	3
POLS 451	Comparative Politics Core	3
POLS 425	Nationalism,Regionalism, and Populism	3
IR 322	Poverty and Development	4
IR 323	Political Economy of Industrialization and Development	4
IR 340	Course IR 340 Not Found	4
IR 344	International Politics of Oil	4
IR 345	Democratization	4
IR 346	Contemporary Ethical Dilemmas in World Politics	4
IR 347	Non-State Actors in a Globalized World	4
OTHER POL 400+ and IR 300+ courses with advisor approval		
Focus 3: ECONOMICS (12 CREDITS, select 4 courses from below)		
ECO 303	Economic Development	3
ECO 339	International Trade	3
ECO 340	International Finance	3
ECO 342	The Chinese Economy - A Comprehensive Study	3

ECO 343	Course ECO 343 Not Found	3
ECO 472	Course ECO 472 Not Found	3
ECO 473	Course ECO 473 Not Found	3
OTHER ECO 400+ with advisor approval		
Focus 4: HISTORY (12 CREDITS, select 4 courses from below)		
HIST 401	Historical Research	3
HIST 404	Readings in the History of the Atlantic World, 1500-1900	3
HIST 443	Readings in English History	3
HIST 444	Readings in Latin American History	3
HIST 447	The French Revolution and Napoleon: A Global History	3
HIST 453	Research in English History	3
HIST 454	History of Global Fascism	3
HIST 457	Research in European History	3
OTHER HIST 400+ courses with advisor approval		

The M.A. in Comparative and International Education (CIE) guides students in the examination of educational policy and theory on an international level, taking into consideration the impact of global economic, political, sociological, and historical factors on educational systems. A focus on interdisciplinary approaches to comparative and international education provides students a foundation for examining both educational research and policy. Graduates are prepared to work in educational research and policy organizations, government offices, ministries of education, and international development organizations.

The M.A. in CIE is a 36 credit hour program comprised of 18 credit hours of required (core) courses, 6 credit hours of electives, 12 credit hours of disciplinary-focused courses, and 3 capstone research credit hours.

Master of Education in Globalization and Educational Change

CIE 400	Course CIE 400 Not Found	3
CIE 401	Course CIE 401 Not Found	3
CIE 402	Course CIE 402 Not Found	3
CIE 403	Course CIE 403 Not Found	3
CIE 471	Course CIE 471 Not Found	3
EDUC 403	Research	3

In addition, students take a minimum of 12 credits in a Concentration area. Concentration coursework is designed by each student and faculty advisor in close collaboration to fit the interests and situation of the student's current and/or potential needs. In addition, students may choose to concentrate in one of the following areas exclusively, which then leads to concurrent receipt of the M.Ed. in Globalization and Educational Change plus a Post-Baccalaureate Certificate in the specified area: 1) International Counseling (12 credit minimum), 2) International Development in Education (12 credit miminum), 3) Special Education (12 credit minimum), 4) Teaching English to Second Language Learners (12 credit minimum), 5) Technology Use in the Schools (12 credit minimum), 6) Women, Gender, and Sexuality Studies (12 credit minimum)

The M.Ed. is a 30-credit-hour program, which is designed to equip graduates to understand, participate in, and make data-driven decisions in and about schools and education institutions — both in the U.S. and internationally. It is a practitioner-oriented program with concentrations in education-related areas (e.g., international counseling, international education development, TESOL, special education, and technology use in schools). Program curriculum explores how education is related to economic, political, and social globalization, as well as examines how education policies, structures, and practices are contextualized in different geopolitical contexts.

International Development in Education Certificate

The post-baccalaureate certificate program in International Development in Education (IDE) provides a foundation in the theoretical concepts of, and practical skills in, education and international development. Certificate holders are prepared to assess and solve education problems in international development, understanding different socioeconomic and political contexts in the global milieu, and work towards educational equity. From examining the work of international development agencies to learning the skills of program evaluation and proposal writing, certificate holders are prepared to work in NGOs, international development agencies, and multilateral organizations.

CIE 404	Course CIE 404 Not Found	3
CIE 405	Course CIE 405 Not Found	3
CIE 406	Course CIE 406 Not Found	3
CIE 407	Course CIE 407 Not Found	3

Courses

CIE 499 Dissertation 1-15 Credits

Counseling Psychology

Overview Tab

The Counseling Psychology program offers 4 degrees: M.Ed. (and certification) in School Counseling (48 credits); M.Ed. in Mental Health Counseling (60 credits); M.Ed. in International School Counseling (36 credits); and Ph.D. in Counseling Psychology. The program also offers a Lehigh graduate certificate in International School Counseling and College Admissions Counseling Certificate.

The M.Ed. in School Counseling is approved for certification (pre-K-12) by the Pennsylvania Department of Education (PDE); the M.Ed. program in Mental Health Counseling is accredited by the Master's in Psychology and Counseling Accreditation Council (MPCAC), and the Ph.D. program is accredited by the American Psychological Association (APA).

Our counseling psychology programs (Ph.D. and M.Ed. in Mental Health Counseling) adhere to *The Benchmark Competencies for Professional Psychology* (Campbell, Fouad, Grus, Hatcher, Leahy, & McCutcheon, 2013). The M.Ed. program in School Counseling and International School Counseling adheres to the PDE competencies for pre-K-12 School Counselors.

Counseling Psychology prepares students as competent and effective scientist-practitioners who demonstrate and strive for self-awareness, knowledge, and skills, undergirded by an attentiveness and responsiveness to multiculturalism and social justice.

Students who complete the M.Ed. in School or International School Counseling typically seek positions in public, private, and international educational settings as school counselors. Students who complete the M.Ed. in Mental Health Counseling seek a variety of positions, including community and agency counseling, independent practice, doctoral-level work, business and industry, and they often seek licensure as a Licensed Professional Counselor (LPC). Students completing the Ph.D. in Counseling Psychology typically seek positions as professional psychologists in hospitals and mental health centers, university counseling centers, independent practice, government positions (for example, Veterans Administration, public health) or as university professors.

Students and faculty are active in local communities, doing research in gender-based violence, mitigation of health disparities by increasing access to culturally-responsive behavioral health care, health and functioning of older adults, implementation and outcomes associated with building a race-centered trauma-responsive school, and NIH-funded research on attachment-based interventions for racially and ethnically diverse families with young children. maternal attachment and emotional regulation, and NIH-funded projects on Latino health behaviors, and with inner city adolescents in the Lehigh Valley. The Counseling Psychology program also runs a summer institute on international counseling and conducts training of counselors globally. In addition, the Community Voices Clinic (CVC) (https://ed.lehigh.edu/cvc/) is a school-based integrated mental health clinic, located at Broughal Middle and Donegan Elementary Schools, that provides mental health services to uninsured and underinsured families and communities in Southside Bethlehem. Many of our students co-publish and co-present nationally with faculty members.

For additional information about the program, please visit:

http://ed.lehigh.edu/academics/disciplines/cp (http://ed.lehigh.edu/academics/disciplines/cp/)

Questions regarding APA Accreditation may be addressed to the APA Office of Accreditation at:

Office of Program Consultation and Accreditation
750 First St, NE, Washington, DC 20002-4242
Telephone: (202) 336-5979 TDD/TTY: (202) 336-6123 Fax: (202) 336-5978
Email (apaaccred@apa.org) (General Questions) (apaaccred@apa.org)
Email (aro@apa.org) (Annual Report Online only)

Doctor of Philosophy in Counseling Psychology

Currently, the doctoral program requires a total of 99 credits, which are composed of 30 master's level credits plus 69 doctoral level credits. A student who enters the counseling psychology doctoral program already holding a master's degree, regardless of where the degree was obtained, may be exempted by her or his advisor from taking up to a total of the 30 credits of required master's level coursework, with the exemption granted based on a review of the student's transcript and/or course syllabi to ensure that the course or courses were of similar content to the course offered by Lehigh. These exempted credits do count toward the total needed for the doctoral degree (currently 99), but will not appear on the student's Lehigh transcript. After conferring with their advisor, the student will complete an internal petition to have these credits exempted, and this petition must be approved by the program director.

Required Master's Level Coursework		
EDUC 403	Research	3
EDUC 408	Introduction to Statistics	3
CPSY 427	Assessment and Appraisal in Counseling	3
CPSY 439	Theory and Practice of Group Counseling	3
CPSY 440	Introduction to Family Counseling	3
CPSY 442	Counseling and Therapeutic Approaches	3
CPSY 430	Professional Seminar	3
CPSY 451	Helping Skills	3
CPSY 455	Advanced Techniques in Counseling	3
EDUC 471	Diversity and Multicultural Perspectives	3
Doctoral Coursework *		
General Psychology Core		
(3) Biological Bases of Behavior (e.g., physiological psychology, comparative psychology, neuropsychology, sensation, psychopharmacology)		
BIOS 404	Behavioral Neuroscience	3
or EDUC 491	Advanced Seminars: (with subtitle)	
(3) Cognitive-Affective Bases of Behavior (e.g., learning, memory, perception, cognition, thinking, motivation, emotion)		
EDUC 451	Cognition and Emotion	3
(3) Social Bases of Behavior (e.g., social psychology; cultural, ethnic and group processes; sex roles; organizational systems and theory)		
EDUC 473	Social Basis of Human Behavior	3
(3) Individual Behavior (e.g., personality theory, human development, individual differences, abnormal psychology)		
CPSY 472	Human Development Across the Lifespan	3
(3) History and Systems of Psychology		
CPSY 484	History and Systems of Psychology	3
(12) Counseling Psychology Core		
CPSY 460	Foundations of Counseling Psychology	3
CPSY 436	Culture-Centered Career Intervention	3
CPSY 473	Advanced Research Methods in Applied Psychology	3
CPSY 481	Advanced Multicultural Counseling	3
(6) Assessment Core		
EDUC 412	Advanced Applications of Psychometric Principles	3
CPSY 461	Assessment of Adult Intellectual Functioning	3
or SCHP 422	Assessment of Cognition and Achievement	
CPSY 462	Assessment of Personality	3
CPSY 466	Current Issues in Counseling and Therapy (Projective Techniques - Optional)	
(3) Advanced Applications in Counseling		
CPSY 476	Supervision and Consultation in Counseling	1-6
(3) Advanced Seminar		
CPSY 466	Current Issues in Counseling and Therapy	3
or CPSY 467	Doctoral Seminar In Counseling Psychology	
(5) Apprenticeship		
CPSY 482	Practicum in University Teaching: Counseling Psychology	1-4
CPSY 470	Independent Study and Research (Research Apprenticeship)	1
CPSY 477	Supervision Apprenticeship	3
(6) Research Methods		
EDUC 410	Univariate Statistical Models	3
EDUC 411	Multivariate Statistical Models	3
(9) Practicum		
CPSY 487	Advanced Doctoral Practicum I	3
CPSY 488	Advanced Doctoral Practicum II	3
CPSY 489	Advanced Doctoral Practicum III	1
CPSY 491	Advanced Doctoral Practicum IV	1
CPSY 492	Advanced Field Placement (if not taken as part of master's [course can be repeated])	1
(2) Internship		
CPSY 498	Counseling Psychology Doctoral Internship (2 semesters full-time, or four semesters half-time)	2
(1) Qualifying Project [1]		
EDUC 486	Doctoral Qualifying Research Project	1
(at least 4) Dissertation [2]		
CPSY 499	Dissertation (Note credit requirement explained in dissertation section)	4
Total Credits		**97-105**

*

After the student has completed the first 15 hours of graduate work, the student is specifically reviewed for full admission. This review is completed during the annual review process for any student who has completed 15 hours. The student's coursework and performance and progress in the doctoral program are reviewed by the faculty. Any questions about the student's progress and plans are raised and discussed, and a vote is then taken to admit the student. The College of Education then writes a letter of admittance to the student specifying the time line for completion of all degree requirements. Students entering with a bachelor's degree have 10 years to complete all degree requirements. Students entering with a master's degree have 7 years to complete all degree requirements

[1]

The purpose of the doctoral qualifying research project is to demonstrate research competence and to lay the groundwork for the student's dissertation. **The doctoral qualifying project must be completed before application for the pre-doctoral internship can be approved.** The project is research undertaken by the student in consultation with the research advisor and is presented in two forms:

1. **A written manuscript in APA (6th edition) format in a condition suitable for submission in a professional journal** (with one variance; see below). Acceptance for publication is not required to meet this requirement, but it is expected that research projects will be submitted for publication in a timely fashion following completion.
2. **Presentation of the project at a public colloquium**.

[2]

Prior to, and including the semester in which a proposal is approved, students must register for 3 dissertation credits each fall and spring semester. Similarly, for the semester(s) following the approval of the dissertation proposal, students must take 1 maintenance of candidacy credit up until, and including, the semester in which the dissertation is defended. The only exception to this policy is during the time the student is on internship, **during which only internship credits need to be taken**. The matter of taking these dissertation credits should be taken seriously. Students who do not follow this procedure, and take fewer credits than required, will find that they will not be able to graduate until back-credits are paid for.

Master of Education in Mental Health Counseling

This professional preparation program reflects competencies required by regulations governing licensure as a Licensed Professional Counselor (LPC) in Pennsylvania. The M.Ed. program is designed to provide the basic coursework as well as the specialized counseling "common core" coursework, and practical experience and professional concentration for certification as a school counselor in the Commonwealth of Pennsylvania; as preparation for further graduate study (i.e., doctoral study [see Ph.D. program manual]).

Shared Core Courses		
CPSY 427	Assessment and Appraisal in Counseling	3
CPSY 436	Culture-Centered Career Intervention	3
CPSY 442	Counseling and Therapeutic Approaches	3
CPSY 451	Helping Skills	3
EDUC 471	Diversity and Multicultural Perspectives	3
CPSY 472	Human Development Across the Lifespan	3
EDUC 403	Research	3
Mental Health Counseling Track		
CPSY 430	Professional Seminar	3
CPSY 439	Theory and Practice of Group Counseling	3
CPSY 440	Introduction to Family Counseling	3
CPSY 455	Advanced Techniques in Counseling	3
EDUC 408	Introduction to Statistics	3
Clinical Training		
CPSY 479	Master's Counseling Practicum [2]	3
CPSY 480	Master's Internship I	3
CPSY 483	Master's Internship II	3
Specialty		**15**
At least one advisor approved 3 credit elective from each of three areas (9)		
Biological and Neuropsychological bases of behavior (3)		
Social Justice, Diversity, Trauma and Loss (3)		
Abnormal Behavior and Psychopathology (3)		
Six additional credits of advisor approved electives (6) [2]		
Total Credits		**60**

[1]

CPsy 479: Practicum is taken for 3 credits

[2]

CPsy 466: Current Issues in Counseling and Therapy is an option for electives

[*]

Total Credits for Proposed Program are 60, consistent with MPCAC Accreditation recommendations and PA Licensure Standard.

Master of Education in International SCHOOL Counseling

The Master's program in International School Counseling is designed to prepare professional school counselors for practice in International School settings. This program provides students with an understanding of the counselor's role within the context of a global third culture community in overseas schools and communities. Coursework addresses fundamental competencies needed to work in schools. The International School Counseling program is developmental/contextual in nature and presumes that school counselors must work in an increasingly diverse cultural and economic environment, and that school counselors in International School settings must understand and be prepared to adapt to changing societal conditions and demands placed upon Third Culture Kids.

Summer Institute I - Summer Session I [^]		
CPSY 452	Helping Skills in International Settings [*] [+]	3
CPSY 453	International School Counseling I [*] [+]	3
CPSY 456	International School Counseling II: Trauma & Resilience in Schools	3
Year I		
Fall Semester		
CPSY 436	Culture-Centered Career Intervention (online) [*]	3
CPSY 457	International School Counseling III: Issues & Practicum	3
January Intersession		
CPSY 472	Human Development Across the Lifespan	3
Spring Semester		
CPSY 442	Counseling and Therapeutic Approaches (online) [*]	3
SPED 332	Introduction to Inclusion and Exceptional Education	3
Summer Institute II - Summer Session II [^]		
EDUC 471	Diversity and Multicultural Perspectives	3
CPSY 430	Professional Seminar [*]	3
CPSY 438	School-Based Small-Group Counseling	3
Year 2		
Fall Semester		
CPSY 480	Master's Internship I (online)	3
SPED 465	Advanced Inclusionary Practices in K-12	3
January Intersession		
EDUC 403	Research	3
Spring Semester		
CPSY 483	Master's Internship II (online)	3
CPSY 427	Assessment and Appraisal in Counseling	3
Total Credits		**48**

Electronic Portfolio Completion Form Signed Off

Technology Requirement (An Electronic Portfolio submission is required), complete online registration each semester, receive orientation from LTS staff on use of the portal, use Course Site for at least one course, and take at least one Information Resources Mini Course as well as participate in the LU CP Listserv.

NOTE: Ten of the above courses will be offered online. Online courses may be offered in a variety of formats, including synchronous (i.e., everyone online at the same time), asynchronous (i.e., each student goes online at different times based on his/her schedule), or a combination of these formats.

^
In Bethlehem or International Location

+
All courses must be completed with a grade of B or better prior to the internship application being submitted.

*****
Prerequisites for Master's Internship I & II

******
SPED 332 is a prerequisite for CPSY 438: Small-group school-based counseling and SPED 465

MASTER OF EDUCATION IN SCHOOL COUNSELING & PENNSYLVANIA STATE CERTIFICATION

The curricula and PDE standards for our school counseling program are detailed in this section.

M.Ed. in School Counseling Curriculum

Shared Core Courses (21 cr.)		
CPSY 427	Assessment and Appraisal in Counseling	3
CPSY 436	Culture-Centered Career Intervention	3
CPSY 442	Counseling and Therapeutic Approaches (*)	3
CPSY 472	Human Development Across the Lifespan	3
EDUC 471	Diversity and Multicultural Perspectives	3
EDUC 403	Research (***)	3
CPSY 451	Helping Skills (*)	3
School Counseling Track (17 cr.)		
CPSY 445	School Counseling I (*)	4
CPSY 448	School Counseling II (*)	3
CPSY 449	School Counseling III (*)	4
SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 465	Advanced Inclusionary Practices in K-12 (****)	3
Clinical Training (9 cr.)		
CPSY 479	Master's Counseling Practicum	3
CPSY 480	Master's Internship I	3
CPSY 483	Master's Internship II	3
Specialty and Technology Requirement		
1 Advisor Approved Elective		3
Electronic Portfolio Completion Form Signed Off		
Technology Requirement (An Electronic Portfolio is required, student must post it to Web space), complete online registration each semester, receive orientation from LTS staff on use of the portal, use Course Site for at least one course as well as participate in the LU CP Listserv)		

NOTE: Students seeking LPC status should also register for CPSY 439 and CPSY 430 as two of their additional courses for licensure beyond the 48 credits required for the degree.

* This course must be taken and passed with a grade of B or better before student can start the internship sequence. ** This course must be taken and passed with a grade of B or better and satisfactory levels of counseling-related and professional competencies before the student can take CPSY 483. *** EDUC 403 and EDUC471 are generally offered every semester and in the summer. EDUC 471 must be taken before CPSY 483 and must be passed with a B or better. **** SPED465 must be taken in a fall semester (other semester offerings are limited to SPED students). Note that SPED332 is a prerequisite course to SPED465.

Total Credits	**50**

international school counseling certificate

The Post-Baccalaureate Certificate in International Counseling is a joint venture between the Counseling Psychology Program and the College of Education's Office of International Programs at Lehigh University.

Career, academic, cultural transition, and mental health issues have become a main focus in international schools. This certificate emphasizes counseling in community, school, and family settings within international communities. The certificate program at Lehigh University consists of a concentration of 4 courses (12 credit hours) in the area of International Counseling. **Students must complete the 4 courses over the span of one year.** Typically students sequence courses in following manner: Summer (host country site), Fall (on-line), Spring (on-line), Summer (host country site). However, students may take courses off-sequence to fit their program of study.

CPSY 436	Culture-Centered Career Intervention	3
CPSY 442	Counseling and Therapeutic Approaches	3
CPSY 452	Helping Skills in International Settings	3
CPSY 453	International School Counseling I	3
Total Credits		**12**

College Admissions Counseling CerTIFICATE

The graduate certificate in College Admissions Counseling provides academic training and professional development for educators and school counselors around the globe who are currently working as, or would like to work as, a secondary high school college counselor. Courses cover developing helping skills, the foundations of university admissions counseling, building healthy school communities, and working with families from diverse backgrounds. Working with international university applicants, third culture kids, and parents is a focus of the program. Approaches are based on empirical models and discuss recent research in the field.

Required Courses:		
CPSY 412	Introduction to University Admissions Counseling	3
CPSY 413	Counseling the Diverse University-Bound Student	3
CPSY 452	Helping Skills in International Settings	3
CPSY 453	International School Counseling I	3
Total Credits		**12**

Courses

CPSY 403 Doctoral Qualifying Project Proposal Research & Writing 3 Credits

Designing and writing the doctoral qualifying project proposal. Covers principles of research, data collection, with an emphasis on writing an APA-style proposal. Taken by counseling psychology doctoral students following completion of the research apprenticeship.

CPSY 405 Psychology of Immigration from Latin America 3 Credits
This course is an introduction to the psychological experiences of immigrants in the U.S., with a major focus on immigration from Latin America. Using a critical lens, students in this course analyze the way that current and historical conditions shape immigrants' mental health and overall wellbeing. This course also draws from research and theory to review strategies for working with immigrants, supporting their resilience and success in educational, work, health, mental health, and community settings.

CPSY 407 (SCHP 407) Crisis Management in the Schools 3 Credits
This course is designed to provide students with knowledge and skills related to crisis preparedness and intervention in the schools. Relevant theories and research literature will be explored as well as practical elements of crisis response that are applicable to all school systems. In addition, intervention strategies and protocols will be examined and discussed.

CPSY 412 Introduction to University Admissions Counseling 3 Credits
Develop skills to provide comprehensive university admissions counseling to high school students and their families around the world. Application of best practices and procedures in the US and abroad. Different components of the college application and selection process.

CPSY 413 Counseling the Diverse University-Bound Student 3 Credits
Working with diverse college-bound student populations and counseling for academic and career readiness. Support families of all backgrounds and interests as they prepare for university.

CPSY 427 (SCHP 427) Assessment and Appraisal in Counseling 3 Credits
Principles of psychological measurement (e.g., tests construction, technology, validity, reliability, functional utility). Ethical, legal, and cultural issues in the administration and interpretation of psychological tests. Case conceptualization, reporting and presentation.

CPSY 430 Professional Seminar 3 Credits
Professional, ethical, and legal issues in counseling. Management and delivery of counseling services in a culturally diverse society. Professional development, certification, licensure, and role identification.

CPSY 431 Latino Health 3 Credits
The course is designed to provide a rich understanding of the factors at the individual, health care provider, institution, and policy level that affect Latino health and health seeking-behaviors in the United States. Research in the disciplines of social and behavioral sciences, epidemiology, health promotion, environmental health, minority health and health disparities, and public policy will be reviewed and discussed.

CPSY 433 Access to Effective Clinical Interventions with Latin American People in the U.S. 3 Credits
This course covers evidence-based, culturally responsive mental health and health service interventions for Latin American people in the US. Students will learn about the inclusion of Latin American individuals in clinical studies testing interventions as well as the application of Latin American cultures in various interventions. This course also reviews the application of broad-based, practical culturally-responsive mental health practices across various health settings and by various health professionals. Other topics addressed include mental health stigma and literacy within the population.

CPSY 436 Culture-Centered Career Intervention 3 Credits
Examination of the career development process and interventions for children, adolescents, and adults with a culture-centered perspective. Study of theorists, vocational assessment process, and occupational and psychological information systems.

CPSY 438 School-Based Small-Group Counseling 3 Credits
Introduction to small group counseling in school settings. Selection of group members; group rules; evidence-based practice with children and adolescents; ethical and cultural considerations with groups.

CPSY 439 Theory and Practice of Group Counseling 3 Credits
Introduction to the process of group counseling and therapy. Selection of group members; group rules; group procedures with children, adolescents and adults; ethical considerations with groups. Study of research on group processes, group therapy, and group leadership. Consent of program director required.

CPSY 440 Introduction to Family Counseling 3 Credits
Research and current trends in the practice of family counseling. Overview and analysis of major theoretical approaches of family therapy.

CPSY 442 Counseling and Therapeutic Approaches 3 Credits
Theory, research, and technique of counseling within a cultural context.

CPSY 445 School Counseling I 4 Credits
Overview of the history, philosophy and current trends in school counseling. Emphasis is placed on (a) professional, ethical, and legal issues in counseling; (b) management and delivery of counseling services in a school setting and culturally diverse society; (c) professional development, certification and role identification; (d) collaboration and consultation with teachers, parents, and administrators. Students will be involved in a pre-practicum observation of school counselors in a K-12 setting.

CPSY 448 School Counseling II 3 Credits
Emphasis on the social and cultural context of school counseling. Includes ethical, legal, and cultural issues in the administration and interpretation of psychological tests used in K-12 settings. Focus on a special topic such as school violence or substance abuse prevention, school and community interaction, and the social and cultural context of school counseling, etc. The course will also include observations in schools.
Prerequisites: CPSY 445

CPSY 449 School Counseling III 4 Credits
Theory and methods of consultation; development and implementation of student assistance programs; intra-and inter-agency collaborations. The course will also include observations in schools.

CPSY 451 Helping Skills 3 Credits
Helping Skills is a course designed to provide counselor trainees with didactic and experiential learning opportunities to facilitate and enhance beginning counseling skills. Counselor trainees will begin to develop an understanding of the counselor’s role in assisting or inhibiting client change. This course utilizes such techniques as modeling, role-playing, audiotape feedback, as well as other learning modalities. Particular emphasis is given to theoretical frameworks, cultural competency, and self-understanding.

CPSY 452 Helping Skills in International Settings 3 Credits
This course assists counselors in developing proficiency in helping skills and an understanding of the counselor's role in facilitating or inhibiting client change. Focus is on acquiring basic helping and therapeutic skills applicable across cultures using empirically based models.

CPSY 453 International School Counseling I 3 Credits
The objectives of this course are for students to gain knowledge related to constructing school-based prevention programs in international settings. Special focus will be paid to designing healthy school communities, understanding the components of an effective school counseling program, and working with children and adolescent students from third cultures and home countries.

CPSY 455 Advanced Techniques in Counseling 3 Credits
This course introduces students to advanced counseling techniques including risk management and empirically supported treatment (EST) approaches. In addition, students will develop knowledge in treatment planning and outcome evaluation and applying EST in a multi-culturally sensitive manner. The course will utilize readings, discussion, film/video clips and presentations to help therapists-in-training develop the awareness, skills, and confidence needed to manage complex therapeutic processes. Emphasis will be placed on student's professional identity development and the ability to engage in counseling relationships.
Prerequisites: CPSY 451

CPSY 456 International School Counseling II: Trauma & Resilience in Schools 3 Credits
This course is designed to provide counseling trainees with a comprehensive exploration of the psychological trauma field; including the history and current theories in the field, the nature of trauma (e.g., sexual abuse, combat, natural disasters); how trauma and loss affects individuals and systems, grief reactions, and traumatic stress; and the diagnosis and treatment (including evidence-based practices) of trauma in diverse children and adult populations. Students will have the opportunity to exercise leadership, clinical, assessment, and consultation skills.
Prerequisites: CPSY 453
Can be taken Concurrently: CPSY 453

CPSY 457 International School Counseling III: Issues & Practicum 3 Credits
Emphasis is on the social and cultural context of international school counseling. Content includes ethical, legal, and cultural issues in the administration and interpretation of psychological tests used in K-12 settings. The focus is on special topics such as school violence, substance abuse prevention, school and community interaction, and the social and cultural context of school counseling, etc. The course will also include a practicum in schools.
Prerequisites: CPSY 456

CPSY 460 Foundations of Counseling Psychology 3 Credits
Knowledge in the core foundations of Counseling Psychology, including the history of Counseling Psychology, multicultural issues, career and vocational counseling, counseling/psychotherapy process and outcome, ethics, prevention and health promotion, social justice and disaster intervention. Must have admission to the Ph.D. program in counseling psychology or consent of the counseling psychology program director required.

CPSY 461 Assessment of Adult Intellectual Functioning 3 Credits
Administration and interpretation of individual tests/batteries of adult intelligence and neuropsychological functioning. Consideration of psychological and cross-cultural issues in intellectual assessment. Preparation of psychological reports. Consent of instructor required.
Prerequisites: CPSY 427

CPSY 462 Assessment of Personality 3 Credits
Consideration of issues and methods of personality assessment, including ethical and legal issues, and cross-cultural issues. Practice in the administration of instruments used for personality assessment. Supervised experience and report writing. Must have admission to the Ph.D. program in counseling psychology.
Prerequisites: CPSY 427

CPSY 464 Gender and Sexuality 3 Credits
In this course, students are introduced to the psychology of gender and sexuality from a variety of theoretical perspectives (e.g., positivist-empirical, postmodern), with attention to how both quantitative and qualitative methodologies are used to inform knowledge. The course examines the ways in which mainstream psychology is gendered and sexed, as well as how various feminist approaches are used to study issues in psychology. The intersection of race/ethnicity, sexual orientation, and social class are also addressed.

CPSY 465 Addictions: Assessment, Treatment, & Prevention Strategies 3 Credits
Through class discussions, lectures and experiential exercises, as well as guest lecturers, videos, and co-curricular activities, this course explores the issues pertaining to the assessment, treatment, and prevention of addictions with the overall purpose of increasing our scientific and clinical expertise in working with individuals in counseling.

CPSY 466 Current Issues in Counseling and Therapy 1-6 Credits
Examination of an area of counseling or therapy that is of topical interest to students and faculty.
Repeat Status: Course may be repeated.

CPSY 467 Doctoral Seminar In Counseling Psychology 1-6 Credits
Research and writing-intensive seminar on current issues and topics in professional psychology directed to doctoral students in counseling psychology. Permission of CP Training Director.
Repeat Status: Course may be repeated.

CPSY 468 Trauma and Loss 3 Credits
This course aims to train students to address trauma and loss in their clinical work. Topics will include the history and diagnosis of trauma, the neurobiology of trauma, and the trauma experience of survivors of war, disaster, and childhood sexual abuse. Theories and treatment of loss and bereavement are also addressed.

CPSY 470 Independent Study and Research 1-6 Credits
Individual or small group study in the field of counseling. Approved and supervised by the major adviser.
Repeat Status: Course may be repeated.

CPSY 472 Human Development Across the Lifespan 3 Credits
An examination of prevailing theories of human growth and development across the lifespan. Examination of the interactive effect of various age groups upon one another. Particular emphasis on the helping relationships.

CPSY 473 (SCHP 473) Advanced Research Methods in Applied Psychology 3 Credits
For doctoral students in applied psychology. Issues and methods of research design, data collection and data analysis. Advanced discussion of quantitative, qualitative and single-case research design. Admission to the Ph.D. program in counseling psychology or school psychology or permission of the instructor.

CPSY 476 Supervision and Consultation in Counseling 3 Credits
Examination of supervision and consultation theory, research and practice within a multicultural framework. Observation and supervision of counseling practicum students. Consultation in clinical settings. For candidates for supervisor's certificate or doctorate in counseling. Consent of instructor required.
Prerequisites: CPSY 488

CPSY 477 Supervision Apprenticeship 3 Credits
The Supervision Apprenticeship normally follows completion of the supervision course CPSY 476 and ensures a full academic year of supervision experience working with master's level trainees under the supervision of a faculty member. Doctoral standing and permission of training director required.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 476

CPSY 479 Master's Counseling Practicum 3 Credits
Practicum field experience in professional practice settings with accompanying weekly seminar meetings. Minimum of 100 documented hours on site.

CPSY 480 Master's Internship I 3 Credits
Twenty hours of weekly supervised internship training for advanced master's level students in individual, group, and family counseling and therapy.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 457 or CPSY 479

CPSY 481 Advanced Multicultural Counseling 3 Credits
This seminar covers models and theories of multicultural counseling and intervention. Students should be actively engaging in practice with multicultural clients in a practicum or field site, and these cases will form part of the basis of course discussions. Must have admission to the doctoral program in counseling psychology. Consent of counseling psychology program director required.
Prerequisites: CPSY 471 or EDUC 471

CPSY 482 Practicum in University Teaching: Counseling Psychology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Counseling Psychology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair.
Repeat Status: Course may be repeated.

CPSY 483 Master's Internship II 3 Credits
Twenty hours of weekly supervised professional practice in a school or agency setting as an extension of CPSY 480 Master's Internship I. Onsite supervision, audio and/or video recordings and case presentations required. Consent of counseling psychology clinical coordinator required.
Prerequisites: CPSY 480

CPSY 484 (SCHP 484) History and Systems of Psychology 3 Credits
This doctoral level course is designed as an overview of the history of psychology in the Western world. The historical approaches to this task will include a historical developmental approach to the origins and changes of ideas over time, the study of great persons and schools of thought, and a look at the Zeitgeist of each. This course will examine the nature of psychology as a whole, and the influence of philosophical worldviews in areas such as epistemology, ontology, teleology, and axiology. Part of this study regards the nature of science, and its power and limitations as applied to the understanding of human beings.

CPSY 485 Advanced Psychopathology 3 Credits
This class will cover etiology, assessment, interviewing techniques, establishing a therapeutic alliance, and treatment planning in adult mental disorders. In depth coverage will be given to Axis II disorders. The diagnosis and classification of abnormal behavior using DSM-IV-R medical model will be emphasized. Alternate theories of abnormal psychology will also be discussed.

CPSY 486 Family Counseling Clinic 3-6 Credits
Supervised practicum training for advanced graduate students in family counseling and therapy. Techniques and methods of conducting family counseling and therapy.
Prerequisites: CPSY 480 and CPSY 440

CPSY 487 Advanced Doctoral Practicum I 3 Credits
Supervised clinical experience for entry-level doctoral students with emphasis on the development of intake skills, assessment procedures and intervention skills. Audio and video recording, individual and group supervision. Must have admission to the doctoral program in counseling psychology. Consent of the counseling psychology practicum coordinator required.

CPSY 488 Advanced Doctoral Practicum II 3 Credits
Supervised clinical experience with emphasis on advanced skills in interpretation, case conceptualization from a theoretical perspective, termination and referral, and in the broad array of professional activities normally conducted by a counseling psychologist. Audio and video recording, individual and group supervision. Consent of counseling psychology practicum coordinator required.
Prerequisites: CPSY 487

CPSY 489 Advanced Doctoral Practicum III 1 Credit
Supervised field experience in counseling and therapeutic settings for doctoral students with specific populations. In consultation with on-site supervisor, the student will develop an area of focus for this practicum that will include therapy experience, training and additional assessment skills as needed. Consent of counseling psychology practicum coordinator required.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 488

CPSY 491 Advanced Doctoral Practicum IV 1 Credit
Supervised field experience in counseling and therapeutic settings for doctoral students with specific populations. In consultation with on-site supervisor, the student will develop an area of focus for this practicum that will include therapy experience, training and additional assessment skills as needed. Consent of counseling psychology practicum coordinator required.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 489

CPSY 492 Advanced Field Placement 1-3 Credits
Students perform counseling in university and community agencies under the supervision of the Ph.D. psychologists at the field placement. Open only to students in counseling psychology. Consent of counseling psychology practicum coordinator required.
Repeat Status: Course may be repeated.

CPSY 498 Counseling Psychology Doctoral Internship 1 Credit
A one year full-time or two year half-time supervised internship in professional psychology. Student functions as regular staff member. Regular contact with academic advisor required in addition to end-of-semester evaluation by the internship site and the student. Consent of program director required.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 491

CPSY 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Education and Human Services

The Department of Education and Human Services (EHS) includes five academic programs:

- Counseling Psychology,
- Educational Leadership,
- School Psychology,
- Special Education, and
- Teaching, Learning, and Technology

Although the EHS department does not offer an undergraduate major, the department offers an Education minor, as well as a five-year program leading to a master's degree and certification in a teaching field and Behavior Analysis. Across the five academic programs, the department offers a variety of master's degrees (M.Ed. and M.S.) and doctoral degrees (Ph.D. and Ed.D.), as well as an Educational Specialist degree (Ed.S.). In addition, in cooperation with the College of Business, the department offers a combination MBA/M.Ed. degree. Further, programs in the college offer coursework-only study toward Pennsylvania state certification, without having to earn a degree. Lastly, there are numerous non-degree programs of study in the college leading to a Lehigh University post-bachelor's certificate.

Programs of study vary in the number of credits required for completion. Please consult the appropriate academic program to learn more about those requirements.

Agencies accrediting our programs include the Pennsylvania Department of Education, the American Psychological Association, the National Association of School Psychologists, and the Masters in Psychology and Counseling Accreditation Council.

Graduates of our programs may work in schools or other educational settings, in health settings and agencies, in government agencies and non-governmental organizations focused on education, in industry, in private practice, or as consultants. While many graduates work in the United States, others work in countries around the world. For more

information on what our graduates do after graduation, please consult the appropriate academic program.

The College of Education subscribes to a research-to-practice model, and all academic programs in the department train their graduates in research-based and evidence-based practices and policies that seek to create inclusive environments in which all individuals are able to work to their potential and social justice is well served.

The department is home to projects funded by the National Science Foundation, the National Institutes of Health, and the Department of Education.

Additional information about the department for current students, faculty, and staff is available at https://ed.lehigh.edu/. (http://ed.lehigh.edu/insidecoe/)

The education minor consists of five courses selected from a range of education-related topics. Students, in consultation with an academic advisor from the College of Education, select courses aligned with their interests and future career goals . The minor provides an opportunity for students to critically examine education related practices and policies informed by research and theory. Undergraduates explore career options in education related fields, examining how teaching and learning occur in a variety of professional contexts with learners across the lifespan and with a range of identities (e.g., disability, multilingual learners, cultural diversity). Courses and experiences are intended to enrich an individual's understanding of education as a central socio-cultural intellectual activity that is interdisciplinary and dynamic.

A minor consists of at least 15 credits from the courses listed below (or other courses with advisor approval); the specific content is determined by the department, division, or program concerned. An undergraduate may take these courses with the approval of the advisor and minimum GPA of 3.0. Completion of the minor does not assure admission to one of the Teacher Education Programs to become a certified elementary or secondary teacher.

Fall		
EDUC 383	Supervised Research in Applied Psychology	1-3
EDUC 394	Special Topics In Education	3
EDUC 406	Social Emotional Learning in Context	3
SCHP 404	Introduction to School Psychology	3
SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 408	Basic Principles of Behavior	3
SPED 422	Theory & Philosophy in Behavior Analysis	3
TLT 394	Special Topics in Education:	1-3
TLT 404	Cultural and Linguistic Diversity	3
Spring		
EDUC 383	Supervised Research in Applied Psychology	1-3
EDUC 394	Special Topics In Education	3
EDUC 419	Second Language Acquisition	3
EDUC 420	Contemporary Issues in Multilingual Learner Education	3
EDUC 431	Multi-Tiered Systems of Social-Emotional Support	3
SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 367	Environmental Education	3
TLT 394	Special Topics in Education:	1-3
Summer		
EDUC 391	Educational Linguistics	3
EDUC 394	Special Topics In Education	3
EDUC 456	Trauma and Resilience in Schools	3
TLT 371	The Business, Social, and Education Entrepreneur	3
TLT 380	Child Development and Cognition	3
TLT 411	Early Childhood Education	3
TLT 464	Digital Storytelling	3

TEXT Pending

MASTER OF EDUCATION IN HUMAN DEVELOPMENT:

M.ed. in Human Development (30 credits)

Research Requirement	**3**
Requirement can be met in four ways: The student may complete a specific course about research (for example, EDUC 403, EDUC 461) or an advisor-approved equivalent course; he/she may complete a Qualifying Project proposal with three credits of registration under EDUC 486 (Qualifying Project); she/he may prepare a major literature review under the direction of an advisor while registered for three credits of SCHP 434, in addition to volunteering hours to support faculty and graduate student research; or the student may publish a research study in a refereed journal or present it at a national conference, while registered for three credits of SCHP 434.	
Diversity and Multicultural Perspectives Requirement	**3**
Requirement can be met by completing a specific course focused on the topic (for example, CPSY 471 or SCHP 429), or by completing an advisor-approved equivalent course.	
Topical Elective Courses	**24**
Advisor-recommended and -approved courses related to the field.	
Total Credits	**30**

SOCIAL, EMOTIONAL, AND BEHAVIORAL WELLNESS PREK-12 CERTIFICATE:

A 12-credit Lehigh certificate program designed for students seeking the Pennsylvania Department of Education Social, Emotional, and Behavioral Wellness of PK-12 Students Endorsement. This certificate program provides a concentration of coursework in social and emotional learning for practitioners interested in enhancing their knowledge and skills in implementing evidence-based, trauma-informed, and culturally responsive practices that address the complex social and emotional needs of children and youth.

This 12 credit certificate is designed for students seeking the Pennsylvania Department of Education Social, Emotional, and Behavioral Wellness of PreK-12 Students Endorsement.

1. EDUC 456 Trauma and Resilience in the Schools (3 credits)
   OR
   CPSY 456 International School Counseling II: Trauma and Resilience in Schools (3 credits)

2. EDUC 406 Foundations of Social Emotional Learning (3 credits)

3. Students may elect to take EITHER the sequence of three, 1-credit courses listed below OR the one, 3-credit course listed below:

EDUC 431 Multi-tiered Systems of Social-Emotional Support I: Foundations (1 credit); AND
EDUC 432 Multi-tiered Systems of Social-Emotional Support II: Universal Approaches (1 credit); AND
EDUC 433 Multi-tiered Systems of Social-Emotional Support III: Targeted Approaches (1 credit)
OR
SPED 432 Positive Behavioral Support (3 credit)

4. Students may elect to take EITHER the sequence of three, 1-credit courses listed below OR the one, 3-credit course listed below:

EDUC 434 Prevention and Management of Crisis (1 credit); AND
EDUC 435 Implementation for Equity: Leading Student-Centered Schools (1 credit); AND
EDUC 436 Implementation for Equity: SEL in Action (1 credit)
OR
CPSY/SCHP 407-010 Crisis Management in the Schools (3 credits)

MENTAL HEALTH & EDUCATION OF LATIN AMERICAN PEOPLE IN THE US

Latin American people in the US include individuals who identify as Hispanic, Latina/Latino, Latinx, Latine, Latin, Chicano, immigrants from Latin American countries (ex: Mexico, Guatemala, Peru) and Spain, and folks of Latin American descent or heritage who were born in the US or Puerto Rico. The mental health and overall wellbeing of Latin American people in the U.S. is impacted by many social determinants and structural inequalities (ex: discriminatory policies, lack of access to health and psychological services, income inequality, educational inequity). Latin American people in the U.S. may benefit from mental health service providers, health professionals, and educators who are responsive to their structural needs and cultural strengths. This graduate certificate program is designed for current and future professionals seeking to enhance their skills to serve Latin American people in the U.S. The Certificate is grounded in cultural humility, cultural competence, and evidence-based practices that are responsive to social and structural determinants of mental health. Courses in this Certificate aim to promote knowledge, awareness, and skills about community-based structural intervention, identity and culture, the psychology of immigration, effective clinical interventions, and issues in multilingual learner education.

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Students in the program may choose any 4 courses from the
 following five, which may be completed in any order:
1. EDUC 437 Identity and Cultural Foundations of Latin
 American People in the US
2. EDUC 438 Community Based & Educational Interventions for
 the mental Health of Latin American People in the U.S.
3. CPSY 433 Access to Effective Clinical Interventions with
 Latin American People in the U.S.
4. CPSY 405 Psychology of Immigration from Latin America
5. EDUC 420 Contemporary Issues in Multilingual Learner
 Education in the U.S.
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TEACHING ENGLISH TO SPEAKERS OF OTHER LANGUAGES (TESOL) CERTIFICATE:

This certificate is committed to advancing educators' knowledge and use of evidence-based instructional practices to support the learning and second language development of second language learners. With the understanding that second language learners often have inequitable learning opportunities, this certificate program seeks to assist educators in being agents of social change in education through enhanced knowledge of linguistics and second language instructional practices.

- Three classes from the following: SPED/TLT 404, EDUC 391, 419, 420, or 423.
- One class from the following:
  - Any remaining eligible ESL courses (SPED/TLT 404, EDUC 391, 419, 420, or 423),
  - Any teacher education course from either the elementary or secondary certification track, or
  - Other courses as approved by advisor.

Courses

EDUC 375 (CGH 375, HMS 375) Community Based Participatory Research Methodology 3-4 Credits
The course provides an introduction to the core concepts of community based participatory research (CBPR) methodology applied to social science research to address public health issues. The course will equip students with strategies for developing community academic partnerships as well as to strengthen skills in research methods.
Attribute/Distribution: SS

EDUC 383 Supervised Research in Applied Psychology 1-3 Credits
Provides junior and senior undergraduates a formal supervised research experience in applied psychology. Students are assigned for the semester to a research team led by a participating faculty member in the College of Education.
Repeat Status: Course may be repeated.

EDUC 388 Statistical Computing 3 Credits
Use of one or more major statistical software packages. Principles of data coding, editing, integrity checking, and management. Emphasis on link between personal computers, mainframes, and other software.
Prerequisites: EDUC 408

EDUC 391 Educational Linguistics 3 Credits
Study of language form, language function, and language varieties, among other topics. By collecting and analyzing learner language, students will develop a solid foundation of the system of English, both as it exists and as it is used. Applying this linguistic knowledge to practice, students will learn how to identify learners' linguistic needs; to set priorities and to establish goals for multilingual learners (MLs); and to embed target language forms in authentic tasks.

EDUC 394 Special Topics In Education 3 Credits
Repeat Status: Course may be repeated.

EDUC 401 Globalization and Contextualization 3 Credits
The goal of the course is to clarify what globalization is and to consider the impact of globalizing ideas, structures, and cultures on education, and how educators and other stakeholders respond given their school's or system's unique global context. Through case studies and discussions with real-world school leaders, students explore ways that policies are "borrowed" and both educational cultures and structures are "institutionalized."

EDUC 402 Developmental Psychology 3 Credits
Survey of theories and research concerning perceptual, cognitive, social, and personality development through infancy and childhood. Must have graduate standing.

EDUC 403 Research 3 Credits
Basic principles of research; techniques of gathering and analyzing data; design of studies in education. Emphasis on critical reviews of research reports representing various methodologies. Research report required.

EDUC 404 Globalization and Curriculum Implications 3 Credits
Investigates impact of globalization on curriculum and how curriculum has been utilized in nation building; how tensions between the global and the local are inherent in curriculum; and how curriculum is a site of construction of national and global identities. Global citizenship is one of the major curricula themes of the dynamic intersection between the global and the local. Several theoretical perspectives are presented; curricula are compared across nations to understand how globalizing curricula differs according to culture and language.

EDUC 405 Qualitative Research Methods 3 Credits
Foundations of qualitative design as research methodology for answering questions in education. Topics include history, philosophy, types, methods, applications, and critical reading of qualitative research reports. Emphasis on developing key researcher skills of gaining entrance, collecting, analyzing and interpreting data, establishing credibility, and writing and publishing results.

EDUC 406 Social Emotional Learning in Context 3 Credits
This course takes students from a beginning understanding of social and emotional learning (SEL) and its relevance for educators to an understanding of practices that can be used in schools to promote resilience, wellness, and positive developmental outcomes for all students. Students will examine how the research grounded in different theoretical traditions frames social and emotional wellness and will evaluate whether the practices identified in research can address the needs of specific student populations.

EDUC 407 Grant Writing and Fund Raising in Education 3 Credits
This course provides a comprehensive overview of the grant writing process. All aspects of grant preparation and writing will be reviewed, including preparing to write a grant, identifying funding sources, developing a grant idea, preparing a proposal, determining appropriate funding agencies, and evaluating grant quality.

EDUC 408 Introduction to Statistics 3 Credits
Organization and description of data. Principles of statistical inference including hypothesis testing, interval estimation, and inferential error control. Emphasis on application.

EDUC 409 Analysis of Experimental Data 3 Credits
Emphasis on analysis of variance designs including one-way, factorial, nested, and repeated measures designs. Introduction to multiple regression and the analysis of covariance.
Prerequisites: EDUC 408

EDUC 410 Univariate Statistical Models 3 Credits
The univariate general linear model. Principles of expressing models and hypotheses about those models. Emphasis on similarity among the analysis of variance, multiple regression, and the analysis of covariance. Examples of nonstandard models and generalization to complex designs.
Prerequisites: EDUC 409

EDUC 411 Multivariate Statistical Models 3 Credits
The multivariate general linear model. Principles of expressing multivariate models and hypotheses about those models. Emphasis on similarity among the multivariate analysis of variance, multiple regression, and the analysis of covariance. Examples of non-standard models and generalization to complex designs.
Prerequisites: EDUC 410

EDUC 412 Advanced Applications of Psychometric Principles 3 Credits
Conceptual examination of exploratory and confirmatory factor analysis, cluster analysis, latent-trait modeling, and other advanced psychometric topics.
Prerequisites: EDUC 409 or EDUC 410 or EDUC 411 or SCHP 427 or CPSY 427

EDUC 413 Hierarchical Linear Modeling 3 Credits
This course is designed to introduce students to the theoretical underpinnings and basic applications of hierarchical linear modeling (HLM). At the end of the course, students will understand when HLM is the appropriate analysis of choice as well as be able to analyze multilevel data. Both cross-sectional and longitudinal nestedness will be considered. An understanding of regression analyses is essential for success in this course and is a prerequisite to this class.
Prerequisites: EDUC 410 or EDUC 411

EDUC 414 Structural Equation Modeling 3 Credits
Analysis and interpretation of a variety of structural equation modeling (SEM) procedures including path analysis, confirmatory factor analysis, factorial invariance, full structural equation models, and latent growth models. Understanding and critiquing both theoretical and applied literature relevant to SEM.
Prerequisites: EDUC 410 or EDUC 411

EDUC 419 Second Language Acquisition 3 Credits
Introduces theories of second language acquisition (SLA) and explores current research that addresses the psycholinguistic, affective, and sociocultural dimensions of learning a second language (L2), specifically as they relate to multilingual learners (MLs). SLA theory is fundamental to ESL practitioners' training in teaching and supporting MLs effectively. Although this course has a theoretical focus, practical understanding of how to apply these theories in teaching will also be emphasized.

EDUC 420 Contemporary Issues in Multilingual Learner Education 3 Credits
Current educational, political, and social conditions that make learning English as a second language a matter of educational equity and social justice. Through a synthesis of the latest research and current educational trends, this course takes a critical look at the complexities of contemporary policies, school practices, and prevalent ideologies that both create and reinforce limited educational opportunities for MLs.

EDUC 422 Pedagogy for Second Language Learning 3 Credits
Introduction to research-based principles and strategies that will promote second language acquisition (SLA) for ELLs. Knowing that schools cannot delay or water down content-learning until ELLs have acquired English, this course emphasizes infusing content and language learning both in and outside the general education classroom.

EDUC 423 Curriculum and Materials Design for Multilingual Learners 3 Credits
Design of curricula and materials to meet the needs of multilingual learners (MLs). This course will guide students through the process of creating, adapting, and differentiating materials used in everyday teaching, while also giving students tools to develop curricula for their districts and schools. Students will engage in design and adaptation at many levels from curricula and courses, to assessments, lesson plans, and tasks.

EDUC 424 Practicum in Second Language Teaching 1-3 Credits
Culminating course for students pursuing the ESL Program Specialist Certificate. Throughout the practicum, students will apply the knowledge they have gained about ELL education, theory, and practice to teaching and supporting ELLs in K-12 classrooms. As they teach, students will enhance their professional expertise by evaluating, problematizing and reflecting on their praxis. In doing so, this practicum emphasizes teacher agency and the professional skills needed for self-directed, on-going growth as an ESL practitioner.

EDUC 431 Multi-Tiered Systems of Social-Emotional Support 3 Credits
Training in multi-tiered systems of support (MTSS) to address emotional, social, and well-being of all students. Topics include the rationale for MTSS; Tier 1 evidence-based programs; targeted interventions, at the Tier 2 and 3 levels, to address the continuum of students' behavioral needs; and an overview of the common mental health concerns that PreK-12 students experience. School personnel will learn how to integrate and apply the DSM-5 and IDEA to inform educational and mental health decisions within an MTSS framework.

EDUC 434 Prevention and Management of Crisis 1 Credit
This course is designed to introduce school personnel to crisis response in school settings, focusing on best prevention, intervention, and follow-up practices. School personnel will learn prevention strategies, discuss the considerations in building a crisis response team and learn crisis response methods, including methods of individual and group crisis counseling. Specific crises considered will include suicide, death of a teacher, student, parent, or community member, and school violence.

EDUC 435 Implementation for Equity: Leading Student-Centered Schools 1 Credit
This module is designed to develop school personnel's knowledge about how to organize and implement initiatives that support a student's social, emotional, and behavioral wellness. With an emphasis on implementation and operation, school personnel will focus on inter-system collaboration among community partners to address student social, emotional, and behavioral needs through the implementation of equitable SEL programs and practices. Finally, school personnel will discuss the protections associated with confidentiality.

EDUC 436 Implementation for Equity: Social Emotional Learning in Action 1 Credit
This module is focused on application of social-emotional theories and practices to create equitable learning environments. This course will engage school personnel in identifying one or more inequities within the school context and developing a culturally responsive plan to remediate these inequities. Considering organizational readiness, school personnel will focus on inter-system collaboration among family, school, and community partners to assess and address student social, emotional, and behavioral needs, as well as learn skills to engage youth in decision-making processes.

EDUC 437 Identity and Cultural Foundations of Latin American People in the US 3 Credits
This course offers a survey of the socio-cultural and historical underpinnings of Latin American identity, with a focus on Latin American people in the United States. The course reviews foundation/contextual commonalities in the formation of one "Latin American identity" while emphasizing racial, ethnic, and other heterogeneity within the Latin American community. Some of the topics addressed in the course include pre-colonial foundations, colorism, acculturation, and contemporary issues related to Latin Americans in the U.S.

EDUC 438 Community Based & Educational Interventions for the Mental Health of Latin American People in the US 3 Credits
This course offers an introduction to social determinants of mental and physical health of Latin American people in the US. The course specifically addresses the following social determinants: educational equity, mental health access, health care access, economic stability, neighborhood health, and social and community processes. The course has a participatory component, through which students partner with a community group, organization (mental health agency or healthcare), or school to design a structural intervention that addresses social determinants impacting that community. The.

EDUC 451 Cognition and Emotion 3 Credits
Basic principles and contemporary theories of cognitive psychology and affect will be covered. Experimental research relevant to contemporary theories of cognitive psychology and affect and the application of these theories in educational settings will be reviewed.

EDUC 456 Trauma and Resilience in Schools 3 Credits
This course is designed to provide educators and mental health trainees with a comprehensive exploration of psychological trauma and resilience; including the history and current theories in the field; the nature of trauma; how trauma and loss affects individuals and systems; grief reactions; learning and behavior and traumatic stress; and the development of trauma-responsive schools. Cultural-sensitivity, survivor-centeredness, and social justice efforts are emphasized within a trauma-informed care approach to prevention and practice.

EDUC 461 Single-Subject Research Design 3 Credits
Experimental designs for use with small N's. Topics include design theory and application, experimental validity (internal, external, statistical conclusions and construct validity) and an overview of data analysis procedures.

EDUC 471 Diversity and Multicultural Perspectives 3 Credits
Examination of the influence of culture, gender, and disabilities on behavior and attitudes. Historical and current perspectives on race, culture, gender, sexual orientation, gender identity diversity, and minority group issues in education and psychology. Lecture/small group discussion. This course is restricted to graduate students in the College of Education.

EDUC 473 Social Basis of Human Behavior 3 Credits
Development of human behavior from a social psychological perspective. Emphasis placed on the impact of society upon school-age children and adolescents.

EDUC 474 Behavioral Neuroscience 3 Credits
Humans are biological creatures, and our behaviors and thoughts are influenced and constrained by our physiology. This course will describe how the function of the working brain contributes to our thoughts, feelings, and actions. We will also discuss the implications of a brain-based approach to issues of free will, responsibility, and identity.

EDUC 475 Clinical Psychopharmacology 3 Credits
This course will examine the principle concepts in pharmacology such as pharmacokinetics and pharmacodynamics, different neurotransmitter systems and our current understanding of their relationship to behavior, as well as pharmacological treatment of various psychological or psychiatric disorders. Additionally, we will explore the ethical issues and concerns associated with taking a bioreductive view of psychology, as well as issues relating to advance in new drug development.

EDUC 482 Practicum in University Teaching: Education 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

EDUC 486 Doctoral Qualifying Research Project 1-3 Credits
Design and implement research project under faculty supervision to meet requirements for doctoral programs.
Repeat Status: Course may be repeated.

EDUC 490 Thesis 1-6 Credits

EDUC 491 Advanced Seminars: (with subtitle) 1-6 Credits
Intensive study and discussion of a specialized area. Title will vary.
Repeat Status: Course may be repeated.

EDUC 493 Internship in: (with subtitle) 1-6 Credits
Opportunity for students to apply theory to practice in a variety of educational settings. Students will be supervised in the field and participate in seminars dedicated to addressing specific concerns and issues encountered during their experience. Consent of program director required.

EDUC 494 Field Work in: (with subtitle) 3 Credits
Identification of significant problems in an educational environment, review of the literature, and development of appropriate research plans.

EDUC 495 Independent Study in: (with subtitle) 1-6 Credits
Individual or small group study in the field of specialization. Approved and supervised by the major adviser.
Repeat Status: Course may be repeated.

EDUC 496 Doctoral Research Seminar 3 Credits
For doctoral students. Research design and application to various kinds of educational problems; data collection and analysis. Criticism and evaluation of student proposals.
Repeat Status: Course may be repeated.

EDUC 499 Dissertation 1-15 Credits

Educational Leadership

The Educational Leadership (EDL) program offers a master's (M.Ed.) and a doctoral degree (Ed.D.), both in Educational Leadership. The M.Ed. is offered as hybrid or online learning with optional certification.

In addition to the degree programs, EDL also offers K-12 Principal, Supervisor of Curriculum and Instruction, and Superintendent (Pennsylvania Letter of Eligibility) certification through the state of Pennsylvania.

The Educational Leadership program is approved by the Pennsylvania Department of Education (PDE). Thus, graduates of our approved preparation programs are eligible for state certification.

Our graduates typically assume positions as superintendents, principals, assistant principals, and directors of curriculum and instruction. Some of our graduates are now faculty members in universities where they teach and conduct research. Internationally, our graduates lead schools around the world (for example, in China, Columbia, Italy, and the Middle East).

The Educational Leadership program has a unique blend of both theory and practice, and a long history of excellence and high quality. Students who seek certification as principals or district leaders complete a high quality internship that is supervised by experienced school or school district leaders. In addition, through Lehigh's partnerships and programming, students may have the opportunity to take coursework with peers who work in international schools, bringing a different perspective to their classes. Further, this program has a history of strong commitment to improving educational opportunities for all students. This is evident in the practices of our many graduates who now hold leadership positions in schools and districts in the local area, region, nation and throughout the world.

The *Urban Principals Academy @ Lehigh* (U*PAL) is a master's degree program designed to develop urban school leaders who will think and act in ways that disrupt the stagnation and mediocrity that exists in too many of our nation's schools. This cohort-based program utilizes the underlying themes of creativity and imagination in leadership to address issues of diversity and organizational culture.

For additional information about the program, please visit: https://ed.lehigh.edu/academics/programs/educational-leadership

Doctor of Education in Educational Leadership

This program is designed to develop the leadership abilities of administrators in educational institutions and agencies that support significant educational programs. Through a combination of regular coursework and special seminars, the program stresses the integration of the theoretical and applied aspects of educational leadership. This planning sheet provides direction for the sequencing of courses but allows flexibility to meet the unique needs of students with different backgrounds and career goals. The program requires a minimum of 60 credit hours (post Master's) earned at Lehigh and the completion and defense of a dissertation in a maximum of seven years.

AREA I - ADMINISTRATION AND LEADERSHIP

Section A - Organization and Leadership (9 cr.)		
EDL 400	Organizational Leadership and Change Management *	3
EDL 405	The Principalship II (or advisor-approved organizational leadership course) *	3
EDL 485	The Superintendency (or advisor-approved organizational leadership course) *	3
Section B - Leadership Functions (21 cr. minimum)		
EDL 476	School Resources Management *	3
EDL 477	Seminar in School-Community Relations *	3
EDL 479	School Law and Ethics *	3
EDL 432	Special Education Law	3
EDL 481	Policy and Politics in Public Education	3
EDL 488	Program Evaluation	3
EDL 470	Special Topics in Educational Leadership (management focus)	3
EDUC 495	Independent Study in: (with subtitle) (leadership-functions focus)	3
OR other advisor-approved leadership functions course		
Section C - Curriculum and Instruction (12 cr. minimum)		
EDL 467	Supervision and Professional Development *	3
EDL 468	Applied Learning Theory for School Leadership *	3
EDL 420	Data Based Decision Making	3
EDL 422	Curriculum Management for the School Executive	3
EDL 470	Special Topics in Educational Leadership (curriculum focus)	3
EDL 450	Curriculum Design in a Global Society	3
OR other advisor-approved curriculum and supervision course		
Section D - Addressing the Needs of Diverse Learners (6 cr. minimum)		
EDUC 471	Diversity and Multicultural Perspectives *	3
SPED 332	Introduction to Inclusion and Exceptional Education	3
EDL 430	Development and Administration of Special Education Programs	3
Section E - Research and Measurement (6 cr.)		
EDUC 408	Introduction to Statistics	3
EDUC 409	Analysis of Experimental Data	3
or EDUC 405	Qualitative Research Methods	

AREA II - RESIDENT STUDIES (12 CREDIT HOURS)

EDL 470	Special Topics in Educational Leadership (Introduction to Doctoral Research I)	3
EDL 470	Special Topics in Educational Leadership (Introduction to Doctoral Research 2)	3
EDL 489	Doctoral Seminar in School Administration	3
EDUC 496	Doctoral Research Seminar	3

AREA III - SPECIALIZATION ELECTIVES

May be selected from courses offered in the College of Education, as well as other related disciplines. (Approval of Advisor required.)

AREA IV - DISSERTATION AND CONCENTRATED LEARNING EXPERIENCE

Dissertation: Candidates for the Ed.D. are required to present a dissertation prepared under the direction of a professor.

Concentrated Learning Requirement: This requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. Two semesters of full-time Lehigh Graduate study or 18 credit hours of study, either on or off campus, must be completed within a 15-month period.

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Courses required for the Pennsylvania Superintendent Letter of Eligibility.

Comprehensive examination

The comprehensive examination for Educational Leadership consists of a take-home exam requiring students to conduct a comprehensive review of the literature on a critical issue facing school leaders and policy makers. With three months to respond, students will submit a paper no longer than 12 pages excluding references. The exam will be offered twice a year, Fall and Spring semesters.

In order to qualify to sit for the exam, students must have no open incompletes other than for EdL 489 or Educ 496, and must also have passed EdL 470 with grades of B- or better.

Master of Education in Educational Leadership

The Master's degree is designed to provide a core foundation of understanding in the areas of leadership, organizational development and change management. The 30 credit Master's in Educational Leadership has two tracks that students can choose from--fully online and a hybrid option.

The ten courses below are required for the fully online program.

The hybrid option will be offered face to face and online. The following five core courses are required: EDL400, EDL420, EDL424, EDUC403, EDUC471. The student and the academic advisor should jointly design the five additional courses. Students enrolled in the hybrid program are required to take courses face-to-face in the summer session.

A minimum of 30 credits are required to complete the Master's degree in Educational Leadership.

EDL 400	Organizational Leadership and Change Management	3
EDL 420	Data Based Decision Making	3
EDL 424	Leadership: Self and Groups	3
EDUC 403	Research	3
EDUC 471	Diversity and Multicultural Perspectives	3
EDL 421	Instructional Leadership	3
EDL 423	Leading Inclusive Learning Systems	3
EDL 467	Supervision and Professional Development	3
EDL 476	School Resources Management	3
EDL 479	School Law and Ethics	3
The following courses EDL400, EDL420, EDL424, EDUC403, EDUC471 are required for hybrid program with additional 15 credits of Leadership & Managements Skills approved by advisor. All ten courses required for fully online program.		**30 credits total**

MASTER OF EDUCATION IN EDUCATIONAL Leadership-Urban Principals Academy @ Lehigh (U*PAL)

U*PAL is a cohort-based Educational Leadership Master's/ Certification program that aims to develop visionary, creative urban school leaders. The program emphasizes creativity and imagination in leadership, organizational culture, and issues of race, privilege, and inequality in schools. It stresses the importance of a reflective leadership state of mind.

The program is geared toward working professionals, enrolling primarily teachers and school administrators. Students take courses online during the fall and spring semesters and then gather on Lehigh University's campus in Bethlehem, Pennsylvania, for five weeks of face-to-face classes during two summers. This unique program focuses on developing visionary, creative urban school leaders through team projects and special seminars and workshops. U*PAL students enter the program as a cohort, usually starting in a summer session, and go through together so they learn from each other as well as from Lehigh's noted faculty.

U*PAL masters candidates do research that they apply to realistic team projects pertaining to topical, urban, K-12 situations. The culminating activity is the Capstone Project, where each U*PAL cohort team creates a visionary new school from scratch and presents at a forum open to Lehigh faculty, professional colleagues, and members of the community.

EDL 424	Leadership: Self and Groups	3
EDL 400	Organizational Leadership and Change Management	3
EDL 420	Data Based Decision Making	3
EDUC 471	Diversity and Multicultural Perspectives	3
EDL 404	The Principalship I	3
EDL 421	Instructional Leadership	3
EDUC 493	Internship in: (with subtitle)	1-6
EDL 479	School Law and Ethics	3
EDL 423	Leading Inclusive Learning Systems	3
EDL 476	School Resources Management	3
EDL 467	Supervision and Professional Development	3
EDL 405	The Principalship II	3

Total Sum of Credits: 37

There are two internship courses listed in the course of study that are labeled "Internship in (with subtitle)," and should be labeled as: EDUC 493 Internship in Educational Leadership (1 credit) EDUC 493 Internship in Educational Administration (3 credits)

Courses

EDL 400 Organizational Leadership and Change Management 3 Credits
Theory development relating to individuals and organizations emphasizing leadership, decision-making, motivation, and change. Analysis of existing leadership approaches focusing on demonstrating the application theories to administrative practice.

EDL 404 The Principalship I 3 Credits
Roles, responsibilities, and operational tasks of principals in the first half of the school year; engagement in practical application of the knowledge, theories, systems, and processes with an emphasis on fall semester responsibilities. Focus on applying the skills and knowledge of the course using problem based learning experiences drawn directly from internship. Must be completed during Principal Internship I (EDL 414).

EDL 405 The Principalship II 3 Credits
Roles, responsibilities, and operational tasks of principals in the second half of the school year; engagement in practical application of the knowledge, theories, systems, and processes with an emphasis on budgeting, state testing requirements and closing the school down in the summer. Focus on applying the skills and knowledge of the course using problem-based learning experiences drawn directly from internship. Must be completed during Principal Internship II (EDL 415).
Prerequisites: EDL 400

EDL 408 Central Office Internship I 2 Credits
Practical experiences in meeting the challenges inherent in the Superintendent and associated central office positions. Emphasis on the five basic functional office roles of the superintendent: CEO to the school board, human resource manager, instructional leader, financial manager, and director of community relations.

EDL 409 Central Office Internship II 2 Credits
Practical experiences in meeting the challenges inherent in the Superintendent and associated central office positions. Emphasis on the budgeting process, state testing requirements and other priorities in the second half of a school year. Must have completed Central Office Internship I.
Prerequisites: EDL 408

EDL 414 Principal Internship I 2 Credits
Practical experiences in meeting the challenges inherent in the principal positions during the first half of the school year. Emphasis on data based decision making, instructional leadership, and day to day operations. Must be completed with EDL 404.
Corequisites: EDL 404

EDL 415 Principal Internship II 2 Credits
Practical experiences in meeting the challenges inherent in the principal positions during the second half of the school year. Emphasis on data based decision making, instructional leadership, and day to day operations. Must be completed with EDL 405.
Corequisites: EDL 405

EDL 420 Data Based Decision Making 3 Credits
Theory, research, and processes associated with the design and management of school curriculum; implementation of effective instructional and assessment practices enhancing student learning. School leader's role in designing and implementing a comprehensive school improvement process, and using data to guide curriculum, instruction and assessment program.

EDL 421 Instructional Leadership 3 Credits
Skills, competencies, and best practices of instructional leadership and student achievement. Includes framing and communicating school goals dealing with student learning, supervising and evaluating instructional practices, coordinating the curriculum to student outcomes, monitoring student progress, creating a professional learning community, and engaging in reflective practice as a school leader.

EDL 422 Curriculum Management for the School Executive 3 Credits
A survey of the methods used to facilitate a curriculum development process based on the theories and findings from research and practice. Application of concepts to practical problems in curriculum leadership to acquire skills in the change process for instruction innovation. Emphasis on current theory and research in standards, technology, and curriculum integration.

EDL 423 Leading Inclusive Learning Systems 3 Credits
Issues facing school administrators as they develop and implement plans to address the needs of all students in their schools and districts. Addresses administrators' obligations for the development and monitoring of Individualized Education Programs for children and youth with disabilities as well as other duties encumbered by administrators.

EDL 424 Leadership: Self and Groups 3 Credits
Exploration of the development and practice of leadership with experiential opportunities for application. Formal and informal authority, the practice of leadership, and individual and organizational dynamics are explored to improve the understanding of adaptive work in organizations.

EDL 425 Leading and Managing Change 3 Credits
Practices and theories about reform, change, and decision making look at who you need to communicate with and why each entity needs to be managed differently. Identify the educational stakeholders, the current trends that effect change, and what precipitates the need for change in the educational system. Addresses the process of change as it relates to individuals, the school board, teachers, students, and the administration with special emphasis on leadership, decision-making, motivation, and the dimensions of change.

EDL 426 Introduction to Relational Leadership: Theory and Practice 3 Credits
Theory development relating to individuals and organizations with special emphasis on the superintendents prolonged effective working relationship with the board of education, the administration, the professional and support staffs and the community. Implementation, follow through, and maintenance are emphasized relating to the interpersonal savvy a superintendent needs to effectively establish trust, build and mend relationships, guide decision-making, instill motivation, lead stakeholders and manage change.

EDL 428 Practicum in Supervision of Curriculum and Instruction I 2 Credits
Supervised field experience in all aspects of district-wide curriculum and instructional activities. Requires monthly seminar meetings.

EDL 429 Practicum in Supervision of Curriculum and Instruction II 2 Credits
Advanced supervised field experience in all aspects of district-wide curriculum and instructional activities. Requires monthly seminar meetings.
Prerequisites: EDL 428

EDL 430 Development and Administration of Special Education Programs 3 Credits
Exploration of the research and practice of an effective special education program. Emphasis on curriculum development, field-based research, and data-based decision making program design and evaluation, and the relationship of the special education program to the pupil services program and the regular curriculum.

EDL 432 Special Education Law 3 Credits
An overview of the relevant legislation, regulations, and case law concerning the education of students with disabilities in pre-k through secondary school.

EDL 434 Leadership and Management of Special Education Programs 3 Credits
Introduction to the management practices related to effective leadership of special education programs including budget development and management, staffing, instructional practices, student assessment practices, and parent involvement.

EDL 436 School District Governance: Planning Policy, Ethics and Law 3 Credits
Examines federal and state Department of Education policies, laws, and regulations governing educational practice, policy, ethics and programming at the district level. Topics include a study of policy-making and related policies in a district, the role of the educational community in developing a collaborative decision-making organization, equality of educational opportunity for all students, and how policy efforts are reshaped by federal, state and local systemic reform efforts.

EDL 437 School District Resource Management 3 Credits
Theoretical and practical foundation in school resource allocation from the superintendent district wide perspective. Trends in revenue and expenditures, staffing, and operations, including school board issues, are explored. The economics of education and school business administration are discussed in terms of the policies they affect and create.

EDL 438 Practicum in Supervision of Special Education and Pupil Services Programs I 2 Credits
Supervised field experience in all aspects of district-wide special education programs. Requires monthly seminar meetings.

EDL 439 Practicum in Supervision of Special Education and Pupil Services Programs II 2 Credits
Supervised field experience in all aspects of district-wide special education programs. Requires monthly seminar meetings.
Prerequisites: EDL 438

EDL 440 Development and Administration of Pupil Services Programs 3 Credits
Exploration of the research and practice of an effective comprehensive pupil services program. Emphasis on involvement of community agencies, field-based research, and data-based decision-making, program design and evaluation, and the relationship of the pupil services program to the regular and special education curriculum.

EDL 442 Leadership and Management of Pupil Services Programs 3 Credits
Overview of the management practices related to effective leadership of pupil services programs, including budget development and management, staffing, instructional practices, community agency partnerships, student assessment, legal issues, and parent involvement.

EDL 450 Curriculum Design in a Global Society 3 Credits
Exploration of global issues and their effects on what is taught in schools, specifically in international schools. Emphasis on the analysis of curriculum and the influence that culture plays in decision making.

EDL 452 Comparative Education 3 Credits
Survey of education practices abroad. Systems of articulation, social and legal foundations, and structure in government. Emphasis on the nature and purpose schools in various cultural contexts and the major problems and trends occurring throughout the world.

EDL 461 Facilitating Organizational Inquiry 2 Credits
Exploration into the use of reflective practice and inquiry for professional development and school improvement. Development of group facilitation skills for collective inquiry. Reflection and inquiry will serve as the foundation for development of an action research project.

EDL 462 Transforming the Learner 2 Credits
Exploration of the integration of social, personal, cognitive, and knowledge-building dimensions to support learning and literacy. Focusing on the metacognitive conversations with self and others essential for developing learning and leadership.

EDL 463 Designing Systems of Action 3 Credits
Implementation of action research project. Building understanding of how the project impacts and is influenced by school and community systems. Explores the application of learning theory as related to leadership. Continued development of leadership concept and tools.

EDL 464 Sustaining Learning Communities 2 Credits
Completion of action research. Design and facilitation of a symposium of inquiry results. Review the behaviors of leadership that sustain learning in the classroom, school, and community.

EDL 467 Supervision and Professional Development 3 Credits
Emphasis on establishing skills in human resource management and supervision, including staff selection, supervision models, assessment and feedback methods, managing a diverse workforce, and adult development related to professional growth options. This course is designed specifically for individuals enrolled in a supervisory certification program.

EDL 468 Applied Learning Theory for School Leadership 3 Credits
Overview of the foundations, principles, and theories of curriculum, teaching, and learning. Emphasis on historical perspectives, teaching and learning for understanding, and schools as professional organizations The purpose is to provide prospective administrators with the background for developing a balanced and challenging school-wide curriculum, for supervising instruction, and for supporting school improvement.

EDL 470 Special Topics in Educational Leadership 1-3 Credits
Intensive study and discussion of a specialized area. Title will vary.
Repeat Status: Course may be repeated.

EDL 476 School Resources Management 3 Credits
Theoretical and practical foundation in school resource allocation. Trends in revenue and expenditures, staffing, and operations are explored. The economics of education and school business administration are discussed in terms of the policies they affect and create.

EDL 477 Seminar in School-Community Relations 3 Credits
Analysis and development of the communication and public relations skills needed by educators in dealing with the public.

EDL 479 School Law and Ethics 3 Credits
Examination of legal and ethical issues in effective leadership in the public schools, including awareness, analysis and applications of judicial interpretations of the constitutions, statutes, regulations, and common law relating to educational issues.

EDL 481 Policy and Politics in Public Education 3 Credits
Analysis of the forces, factors, agencies, formal governmental systems and informal subsystems that influence educational policy in local districts and state and national governments.

EDL 482 Practicum in University Teaching: Educational Leadership 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Educational Leadership. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair.
Repeat Status: Course may be repeated.

EDL 485 The Superintendency 3 Credits
A theoretical and historical examination of superintendents' leadership, school board/superintendent relations, and the array of duties and demands upon the superintendency.

EDL 488 Program Evaluation 3 Credits
The historical background, theory, methodology, and current practices of program evaluation in the human services area. Emphasis on conducting evaluations of educational programs and gathering data to make effective program decisions. Participants are required to design a program evaluation research plan.

EDL 489 Doctoral Seminar in School Administration 3 Credits
Analysis of the theoretical, empirical, and conceptual aspects of contemporary issues in educational administration and their implications for policy formulation and implementation in educational institutions. Must have official standing as a doctoral student in educational leadership.

EDL 499 Dissertation 1-15 Credits

School Psychology

The School Psychology Program offers two degree programs: An Educational Specialist (Ed.S.) degree and a doctoral degree (Ph.D.). Certification as a school psychologist in the state of Pennsylvania is associated with both degree programs.

Both degree programs are approved by the National Association of School Psychologists (NASP), while the Ph.D. program is additionally accredited by the American Psychological Association (APA). The Pennsylvania Department of Education has approved our program's certification in school psychology.

Graduates of the Ed.S. program are prepared to serve as school psychologists in school districts. Graduates of the Ph.D. program have a broader range of employment options, including practitioner positions in school district, clinical, and hospital settings, as well as positions as researchers and professors in academic settings.

Fundamental to the School Psychology program is a commitment to a scientist-practitioner model. Students in our degree programs complete coursework and field-based experiences that prepare them to apply critical skills for delivering evidenced-based practices to children and youth. Moreover, our programs operate from an ecological perspective. Students are well prepared to address the contextual influences on children's educational achievement and health.

The School Psychology program continues to develop concentrated training opportunities, including coursework and practicum, in unique areas consistent with faculty expertise for both the Ed.S. and Ph.D. students.

For additional information about the School Psychology program, please visit:

http://coe.lehigh.edu/academics/disciplines/sp (http://coe.lehigh.edu/academics/disciplines/sp/)

Questions regarding APA Accreditation may be addressed to the APA Office of Accreditation at:

Office of Program Consultation and Accreditation
750 First St, NE, Washington, DC 20002-4242

Telephone: (202) 336-5979
TDD/TTY: (202) 336-6123
Fax: (202) 336-5978
Email (apaaccred@apa.org) (General Questions)
(apaaccred@apa.org)
Email (aro@apa.org) (Annual Report Online only)

Doctor of Philosophy in School Psychology

DOCTORAL CORE (3 HOURS)		
SCHP 496	Doctoral Seminar in School Psychology	3
or SPED 490	Doctoral Seminar in Special Education	
PSYCHOLOGICAL FOUNDATION CORE COURSES (18 HOURS)		
EDUC 402	Developmental Psychology	3
EDUC 451	Cognition and Emotion	3
PSYC 404	Behavioral Neuroscience	3
EDUC 473	Social Basis of Human Behavior	3
SCHP 429	Special Topics in School Psychology	1-3
SCHP 484	History and Systems of Psychology	3
RESEARCH CORE (24 HOURS) Required Courses		
EDUC 410	Univariate Statistical Models	3
EDUC 411	Multivariate Statistical Models	3
EDUC 461	Single-Subject Research Design	3
SCHP 406	Research Methods and Design	3
SCHP 408	Dissertation Proposal Seminar	3
EDUC 491	Advanced Seminars: (with subtitle)	1-6
EDUC 412	Advanced Applications of Psychometric Principles	3
EDUC 486	Doctoral Qualifying Research Project	1-3
Electives:		
EDUC 409	Analysis of Experimental Data	3
CPSY 460	Foundations of Counseling Psychology	3
EDUC 495	Independent Study in: (with subtitle)	1-6
SCHP 434	Applied Research Practicum	1-3
PROFESSIONAL SCHOOL PSYCHOLOGY CORE (39 HOURS):		
EDL 400	Organizational Leadership and Change Management	3
SCHP 402	Applied Behavior Analysis	3
SCHP 404	Introduction to School Psychology	3
SCHP 407	Crisis Management in the Schools	3
SCHP 412	Consultation Procedures	2
SCHP 422	Assessment of Cognition and Achievement	3

SCHP 423	Social-Emotional and Behavioral Assessment and Intervention	3
SCHP 425	Academic Assessment and Intervention	3
SCHP 426	Advanced School and Family Interventions	3
SCHP 432	Practicum in Assessment of Cognition and Achievement	1-3
SCHP 435	School-based Practicum	1-3
SCHP 437	Advanced Child Psychopathology	3
SCHP 442	Doctoral Practicum in School Psychology	1-6
SCHP 436	Specialized Practicum in School Psychology	1-3
SCHP 444	Doctoral Internship	1-6
In this program, students have the opportunity to choose one of the two options for developing specialized expertise. These two core options are: 1) School-Based Prevention subspecialization (additional 18 hours, total of 99), 2) Pediatric/Health subspecialization (additional 18 hours, total of 99). DISSERTATION HOURS as necessary - minimum of 2		

Educational Specialist (Ed.S.) program in School Psychology

AREA I:		
RESEARCH CORE (6 hours)		
EDUC 403	Research	3
or SCHP 434	Applied Research Practicum	
EDUC 408	Introduction to Statistics	3
or EDUC 409	Analysis of Experimental Data	
AREA II:		
PSYCHOLOGICAL FOUNDATION CORE (12 HOURS)		
EDUC 451	Cognition and Emotion	3
or PSYC 403	Cognitive Psychology	
PSYC 402	Developmental Psychology	3
EDUC 491	Advanced Seminars: (with subtitle)	1-6
or PSYC 404	Behavioral Neuroscience	
CPSY 471	Course CPSY 471 Not Found	3
AREA III:		
COUNSELING PSYCHOLOGY (3-9 hours)		
CPSY 439	Theory and Practice of Group Counseling	3
CPSY 440	Introduction to Family Counseling	3
CPSY 442	Counseling and Therapeutic Approaches	3
CPSY 445	School Counseling I	4
CPSY 462	Assessment of Personality	3
CPSY 480	Master's Internship I (Others by advisor approval)	3
Others by advisor approval		
AREA IV:		
SPECIAL EDUCATION (3 - 9 HOURS)		
PSYC 338	Phenomenology and Theory of Childhood Disorders	4
SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 418	Alternative Curricular Approaches	3
SPED 419	Intensive Intervention in Reading	3
EDL 470	Special Topics in Educational Leadership	1-3
Others by Advisor Approval		
Autism Subspecialization (6) {Requires 480 clock hours in ASD}		
Bi-weekly Seminar: Autism Spectrum Disorders (0)		
Bi-monthly seminar: Diversity Sensitivity Consulting (0)		
Daily Practicum in Autism Spectrum Disorders (0)		
SPED 465	Advanced Inclusionary Practices in K-12	3
Others by advisor approval.		
Specialist in RTI Implementation (25)		
SCHP 429	Special Topics in School Psychology	1-3
SCHP 437	Advanced Child Psychopathology	3
SCHP 443	Certification Internship	1-6
Others by advisor approval.		
AREA V:		
PROFESSIONAL SCHOOL PSYCHOLOGY CORE (36 HOURS)		
SCHP 407	Crisis Management in the Schools	3
SCHP 402	Applied Behavior Analysis	3
SCHP 404	Introduction to School Psychology	3
SCHP 412	Consultation Procedures	2
SCHP 422	Assessment of Cognition and Achievement	3
SCHP 423	Social-Emotional and Behavioral Assessment and Intervention	3
SCHP 425	Academic Assessment and Intervention	3
SCHP 426	Advanced School and Family Interventions	3
SCHP 431	Course SCHP 431 Not Found	1-3
SCHP 432	Practicum in Assessment of Cognition and Achievement	1-3
SCHP 433	Course SCHP 433 Not Found	1-3
SCHP 435	School-based Practicum	1-3
SCHP 443	Certification Internship	1-6

Courses

SCHP 402 (SPED 402) Applied Behavior Analysis 3 Credits
Theory and application of behavior modification methods in classroom and clinical settings. Topics include behavior analysis, outcome research, task utilization, and single case research.

SCHP 404 Introduction to School Psychology 3 Credits
This course is designed to provide students with an introduction to the profession of school psychology. The course discusses professional, ethical, and legal issues currently facing psychologists who work in schools and other clinical settings. Topics also encompass the historical development, current status, ongoing professional debates, and future opportunities and challenges related to the profession.

SCHP 406 Research Methods and Design 3 Credits
This course is designed to provide skills in the use and application of research methodologies and in the conceptualizing and writing of research proposals. Specifically, the course is focused on developing conceptual knowledge of specific research methods, interpreting data using specific methods of analysis, and developing independent research skills focused around one's own research project. The course is primarily designed for doctoral students in School Psychology and Special Education. Permission of instructor is required.

SCHP 407 (CPSY 407) Crisis Management in the Schools 3 Credits
This course is designed to provide students with knowledge and skills related to crisis preparedness and intervention in the schools. Relevant theories and research literature will be explored as well as practical elements of crisis response that are applicable to all school systems. In addition, intervention strategies and protocols will be examined and discussed. Permission of instructor is required.

SCHP 408 Dissertation Proposal Seminar 3 Credits
The primary purpose of this course is to guide students in their independent research endeavors. Students will learn about the complexities of planning and initiating independent research, focusing on the writing process, methodological issues, and the management of time and data. Knowledge and competencies obtained in this seminar will be applied as students prepare their dissertation proposals.

SCHP 412 Consultation Procedures 3 Credits
Observational methodology utilized in consultation; rationale, theory and methods of consultation; individual, group and parent consulting. Study of research on the consultation process.

SCHP 418 Children in Context: Family, School, and Community 3 Credits
This course provides an advanced, theoretical basis for understanding various contextual influences on children's health, development, and learning. Fundamental to the course is application of ecological systems theory. A specific objective of this course is to develop students' cultural competence for implementing psychological and educational services to children of all ages and backgrounds.

SCHP 422 Assessment of Cognition and Achievement 3 Credits
This course provides training in administration and interpretation of individual tests of cognition and achievement used in school evaluations. Preparation of educational and psychological reports is also covered. Consent of instructor required.

SCHP 423 Social-Emotional and Behavioral Assessment and Intervention 3 Credits
This course provides instruction in assessment methods (direct observation, interviews, checklists, rating scales) and data-based decision making for social-emotional and behavioral concerns in educational settings. Strategies and interventions to support social-emotional and behavioral well-being are reviewed also. Consent of instructor required.

SCHP 425 Academic Assessment and Intervention 3 Credits
This course provides instruction in academic assessment methods (e.g., curriculum based assessment, classroom observation, and teacher interviews) and data-based decision making in educational settings. Strategies and interventions to support academic achievement are reviewed also. Consent of instructor required.

SCHP 426 Advanced School and Family Interventions 3 Credits
Overview of school-based and family-based intervention strategies for children and adolescents presenting interpersonal, emotional, developmental or behavioral challenges. Examples of topics covered include crisis intervention, peer-mediated interventions, self-management interventions, behavioral parent training, interventions for child abuse/neglect and computer-assisted instruction.
Prerequisites: SCHP 402

SCHP 427 (CPSY 427) Assessment and Appraisal in Counseling 3 Credits
Principles of psychological measurement (e.g., tests construction, technology, validity, reliability, functional utility). Ethical, legal, and cultural issues in the administration and interpretation of psychological tests. Case conceptualization, reporting and presentation.

SCHP 429 Special Topics in School Psychology 1-3 Credits
Repeat Status: Course may be repeated.

SCHP 432 Practicum in Assessment of Cognition and Achievement 1 Credit
Supervised experience in the administration and interpretation of cognitive and achievement tests.
Corequisites: SCHP 422

SCHP 434 Applied Research Practicum 1-3 Credits
Designing and conducting research projects in applied settings.

SCHP 435 School-based Practicum 1-3 Credits
Supervised experience in the provision of school psychological services including assessment, intervention, and consultation.

SCHP 436 Specialized Practicum in School Psychology 1-3 Credits
Supervised field experience in school psychology with a specific population or setting. Permission of instructor required.
Repeat Status: Course may be repeated.

SCHP 437 Advanced Child Psychopathology 3 Credits
Advanced training in the definition, classification, etiology, long-term outcome, and treatment of children and adolescents with various psychopathological disorders. Emphasis is placed upon the assessment and treatment of child and adolescent psychopathology in school settings. Must have admission to doctoral program or consent of instructor.

SCHP 438 Health/Pediatric Psychology 3 Credits
Introduction to training in the definition, etiology and behavioral/academic characteristics of children and adolescents with medical disorders. Emphasis is placed on the assessment and treatment of educational and behavioral sequelae of medical disorders in both school and health settings. Must have admission to doctoral program in school psychology or consent of instructor.

SCHP 439 Comprehensive School Health Programs 3 Credits
Examination of school-wide programs designed to address health care needs of children and adolescents in school settings. Focus is on development of primary prevention and integration of educational, medical, social and community resources. Permission of instructor required.

SCHP 440 Applications of Pediatric School Psychology 3 Credits
Focus on further development of students' knowledge and application of pediatric school psychology. The etiology and developmental course of pediatric medical conditions will be examined, emphasizing the impact on school, family and community environments.
Prerequisites: SCHP 438 or SCHP 439

SCHP 442 Doctoral Practicum in School Psychology 1-6 Credits
Field-based experience in providing psychological services in school and/or clinical settings. Must have admission to doctoral program.
Repeat Status: Course may be repeated.

SCHP 443 Certification Internship 1-6 Credits
Full-time experience in clinical/educational settings. Student must complete a minimum of 1,200 clock hours under joint supervision of faculty and field supervisor.
Repeat Status: Course may be repeated.

SCHP 444 Doctoral Internship 1-6 Credits
Full-time experience in clinical/educational settings. Student must complete a minimum of 1,500 clock hours under joint supervision of faculty and field supervisor.
Repeat Status: Course may be repeated.

SCHP 473 (CPSY 473) Advanced Research Methods in Applied Psychology 3 Credits
For doctoral students in applied psychology. Issues and methods of research design, data collection and data analysis. Advanced discussion of quantitative, qualitative and single-case research design. Admission to the Ph.D. program in counseling psychology or school psychology or permission of the instructor.

SCHP 482 Practicum in University Teaching: School Psychology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in School Psychology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

SCHP 484 (CPSY 484) History and Systems of Psychology 3 Credits
This doctoral level course is designed as an overview of the history of psychology in the Western world. The historical approaches to this task will include a historical developmental approach to the origins and changes of ideas over time, the study of great persons and schools of thought, and a look at the Zeitgeist of each. This course will examine the nature of psychology as a whole, and the influence of philosophical worldviews in areas such as epistemology, ontology, teleology, and axiology. Part of this study regards the nature of science, and its power and limitations as applied to the understanding of human beings.

SCHP 496 Doctoral Seminar in School Psychology 3 Credits
Selected topics in school psychology (titles will vary) including professional issues, assessment and intervention in school settings, and supervision of school psychology services. Must have admission to doctoral program.
Repeat Status: Course may be repeated.

SCHP 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Special Education

The Special Education program offers the following degree programs: Master of Education (M.Ed.) in Special Education, Master of Education (M.Ed.) in Behavior Analysis, and Doctor of Philosophy (Ph.D.) in Special Education.

Students have options within the master's degree program to pursue Pennsylvania state teacher certification. All teacher certification programs are fully accredited by the Pennsylvania Department of Education. These options include:

- Certification in Special Education PreK-12
- Dual certification in Special Education PreK-12 and general education PreK-4
- Dual certification in Special Education PreK-12 and general education 7-12
- English as a Second Language (ESL) Program Specialist Certification

For individuals already certified, they may enroll in a post-certification Master's in Special Education degree program or Master's in Behavior Analysis degree program to build upon their professional expertise. Students may pursue course work focused on intensive academic/behavioral interventions, low incidence disabilities, and/or work toward the Board Certification Behavioral Analyst (BCBA) Examination within the post-certification master's degree programs.

Students who complete the master's degree with teaching certification are fully qualified to teach special education in PreK-12 school settings. Teacher graduates may assume a variety of roles as teachers in self-contained classrooms, co-teachers in inclusive classrooms, itinerant support or consultants, and transition coordinators. Some graduates choose to work in community settings, providing behavioral support or services to non-school age individuals with disabilities.

Students who complete the Ph.D. program are fully prepared to conduct research and teach in college or university settings. Alternatively, some graduates assume leadership positions, directing school, district, or state-level programs or participating in state or national educational policy or teacher training initiatives.

The Special Education program emphasizes the use and development of evidence-based and other innovative practices that make meaningful differences in the lives of individuals with disabilities. Our master's students are trained a variety of intensive academic and behavioral interventions to support students with disabilities in a variety of settings. The Ph.D. program is individualized and emphasizes the development of professional competencies in research, teacher training, and dissemination. Two unique features of our program are our small Ph.D. cohorts, which allow for personalized faculty-student mentoring, and cross-collaboration with other programs within the college (for example, School Psychology; Educational Leadership; and Teaching, Learning and Technology).

Special Education faculty members are continuously immersed in research and service projects that bring nationally recognized innovations to schools and community settings that support individuals with disabilities. Students may have the opportunity to work with faculty on projects supported by competitive university, state, foundation and federal grants and contracts. Recent projects/programs include:

- Evaluating the effectiveness of Tier 3 mathematics interventions for students with persistent difficulties in learning mathematics,
- Investigating structural inequalities that constrain the learning opportunities and bilingual development of multilingual learners with disabilities,
- Investigating the use of non-concurrent multiple baselines in special education,
- Developing a culturally appropriate screener to identify autism in Sierra Leone,
- Developing and evaluating a supported college and career readiness program for at-risk high school students,
- Evaluating the effects of an education program for parents of preschool children with or at-risk for attention deficit hyperactivity disorder (ADHD), and
- Evaluating adaptations to Tier 2 interventions in the context of School-Wide Positive Behavior Support.

For additional information about the program, please visit: http://coe.lehigh.edu/academics/disciplines/sped (http://coe.lehigh.edu/academics/disciplines/sped/)

4+1 Bachelor's Plus Accelerated Master of Education in Special Education and PreK-12 Certification

This 39-credit (minimum) master's program prepares students for certification as PreK-12 special education teachers.

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 407	Instructional Design for K-12 Classrooms	3
SPED 404	Cultural and Linguistic Diversity	3
SPED 409	K-12 Classroom Environment and Management	3
SPED 411	Early Childhood Education	3
SPED 418	Alternative Curricular Approaches	3
SPED 419	Intensive Intervention in Reading	3
SPED 421	Intensive Intervention in Mathematics and Content Area Literacy	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
SPED 432	Positive Behavior Support	3
SPED 452	Assessment in Special Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
SPED 443	Special Education Student Teaching and Seminar	3

Distribution of coursework across undergraduate and graduate study: Sophomore Year (3 credit hours)

Sophomore Year (3 credit hours)

Junior Year (6 credit hours)

Senior Year (9 credit hours)

College of Education - Summer (9 credits) College of Education - Fall (9 credits) College of Education - Spring (3 credits)

Students in the 5-year program will take 18 credits pre-bachelor's and an additional 21 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 9 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

4+1 Bachelor's Plus Accelerated Master of Education in Behavior Analysis

This combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, the College of Business, or the College of Health, and an M.Ed. degree in Behavior Analysis. Core courses in this program have been designed to meet the Fourth Edition Task List and Foundational Knowledge List issued by the Behavior Analyst Certification Board® (BACB®).

Core Coursework (21 credits, core course sequence approved by the BACB®)

The Behavior Analyst Certification Board, Inc.® (BACB®) has verified the following course sequence as meeting the coursework requirements for eligibility to take the Board Certified Behavior Analyst Examination®. Applicants will have to meet additional requirements to qualify (http://bacb.com/bcba-requirements/).

SPED 408	Basic Principles of Behavior	3
SPED 454	Behavior Assessment	3
SPED 455	Intervention and Behavior Change	3
SPED 422	Theory & Philosophy in Behavior Analysis	3
SPED 446	Research Methods in Behavior Analysis	3
SPED 412	Organizational Behavior Management	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3

Other Required Course (3 credits)

EDUC 471	Diversity and Multicultural Perspectives	3

Electives (6 credits)

SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 411	Early Childhood Education	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
EDL 432	Special Education Law	3
EDL 479	School Law and Ethics	3
EDUC 401	Globalization and Contextualization	3
EDUC 406	Social Emotional Learning in Context	3
EDUC 420	Contemporary Issues in Multilingual Learner Education	3
EDUC 422	Pedagogy for Second Language Learning	3
EDUC 423	Curriculum and Materials Design for Multilingual Learners	3
EDUC 431	Multi-Tiered Systems of Social-Emotional Support	3
Other electives as approved by advisor		

Distribution of coursework across undergraduate and graduate study:

Senior Year (6 credit hours)

College of Education - Summer (6 credits)

College of Education - Fall (9 credits)

College of Education - Spring (9 credits)

Students in the accelerated program will take 6 credits pre-bachelor's and an additional 24 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 6 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

Doctor of Philosophy in Special Education

This 60 credit post-master's degree program is individualized and emphasizes applied research, faculty-student mentoring, and the development of professional competencies such as writing for publication, college teaching, grant writing, and program administration.

Doctoral Core (12 credits)

SCHP 496	Doctoral Seminar in School Psychology	3
and/or		
SPED 490	Doctoral Seminar in Special Education	3

Research Core (18 credits)

Required:		
EDUC 410	Univariate Statistical Models	3
EDUC 411	Multivariate Statistical Models	3
Other:		
EDUC 408	Introduction to Statistics	3
EDUC 409	Analysis of Experimental Data	3
EDUC 461	Single-Subject Research Design	3
SCHP 473	Advanced Research Methods in Applied Psychology	1-3
SPED 495	Independent Study in Special Education	1-6

Other courses with approval of adviser.

Special Education Major Core (15 credits)

Choose from special education courses or independent studies in special interest areas with approval of adviser.

Related Areas (9 credits)

EDUC 471	Diversity and Multicultural Perspectives	3

Other courses with approval of adviser.

Apprenticeship (6 credits)

Supervised mentored experiences such as college teaching, student teaching supervision, writing for publication, participation in research projects, presentations at national conferences, grant writing, or educational leadership in schools and community.

Master of Education in Special Education

Course ListThe Master of Education (M.Ed.) degree in Special Education is designed for the college graduate who holds instructional certification in special education and who is interested in pursuing advanced studies in special education. The program offers four areas of concentration, which are listed below. The student must choose one area of concentration, with the advisor's approval.

Concentration 1: Intensive Academic Intervention (30 credits)

Required Core (9 credits)

SPED 419	Intensive Intervention in Reading	3
SPED 421	Intensive Intervention in Mathematics and Content Area Literacy	3
SPED 452	Assessment in Special Education	3

Research Requirement (3 Credits)

EDUC 461	Single-Subject Research Design	3

Diversity Requirement (3 Credits)

SPED 404	Cultural and Linguistic Diversity	3

Electives: Choose 5 Courses with Advisor's Approval (15 Credits)

SPED 402	Applied Behavior Analysis	3
SPED 409	K-12 Classroom Environment and Management	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 411	Early Childhood Education	3
SPED 416	Autism Spectrum Disorders and Evidence-Based Practices	3

SPED 432	Positive Behavior Support	3
SPED 465	Advanced Inclusionary Practices in K-12	3
EDL 432	Special Education Law	3
EDUC 456	Trauma and Resilience in Schools	3
EDUC 406	Social Emotional Learning in Context	3
EDUC 401	Globalization and Contextualization	3

Other electives as approved by advisor

Concentration 2: Low Incidence Disabilities (30 credits)

Required Core (9 credits)

SPED 418	Alternative Curricular Approaches	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
SPED 452	Assessment in Special Education	3

Research Requirement (3 Credits)

EDUC 461	Single-Subject Research Design	3

Diversity Requirement (3 Credits)

SPED 404	Cultural and Linguistic Diversity	3

Electives: Choose 5 Courses with Advisor's Approval (15 Credits)

SPED 402	Applied Behavior Analysis	3
SPED 409	K-12 Classroom Environment and Management	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 411	Early Childhood Education	3
SPED 416	Autism Spectrum Disorders and Evidence-Based Practices	3
SPED 432	Positive Behavior Support	3
SPED 465	Advanced Inclusionary Practices in K-12	3
EDL 432	Special Education Law	3
EDUC 456	Trauma and Resilience in Schools	3
EDUC 406	Social Emotional Learning in Context	3
EDUC 401	Globalization and Contextualization	3

Other electives as approved by advisor

Concentration 3: English as a Secondary Language (30 credits)

Required Core (15 credits)

EDUC 391	Educational Linguistics	3
EDUC 419	Second Language Acquisition	3
EDUC 420	Contemporary Issues in Multilingual Learner Education	3
EDUC 423	Curriculum and Materials Design for Multilingual Learners	3
SPED 452	Assessment in Special Education	3

Research Requirement (3 Credits)

EDUC 461	Single-Subject Research Design	3

Diversity Requirement (3 Credits)

SPED 404	Cultural and Linguistic Diversity	3

Electives: Choose 3 Courses with Advisor's Approval (9 Credits)

SPED 402	Applied Behavior Analysis	3
SPED 409	K-12 Classroom Environment and Management	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 411	Early Childhood Education	3
SPED 416	Autism Spectrum Disorders and Evidence-Based Practices	3
SPED 432	Positive Behavior Support	3
SPED 465	Advanced Inclusionary Practices in K-12	3
EDL 432	Special Education Law	3
EDUC 456	Trauma and Resilience in Schools	3
EDUC 406	Social Emotional Learning in Context	3
EDUC 401	Globalization and Contextualization	3

Other electives as approved by advisor

Concentration 4: General Special Education Studies (30 credits)

Required Core (6 credits)

SPED 452	Assessment in Special Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3

Research Requirement (3 Credits)

EDUC 461	Single-Subject Research Design	3

Diversity Requirement (3 Credits)

SPED 404	Cultural and Linguistic Diversity	3

Electives: Choose 6 Courses with Advisor's Approval (18 Credits)

SPED 402	Applied Behavior Analysis	3
SPED 409	K-12 Classroom Environment and Management	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 411	Early Childhood Education	3
SPED 416	Autism Spectrum Disorders and Evidence-Based Practices	3
SPED 432	Positive Behavior Support	3
SPED 465	Advanced Inclusionary Practices in K-12	3
EDL 432	Special Education Law	3
EDUC 456	Trauma and Resilience in Schools	3
EDUC 406	Social Emotional Learning in Context	3
EDUC 401	Globalization and Contextualization	3

Other electives as approved by advisor

Master of Education in Special Education and Special Education PreK-12 Certification

This 33 credit (minimum) master's program is designed for students seeking Pennsylvania certification as Special Education PreK-12 teachers.

SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 404	Cultural and Linguistic Diversity	3
SPED 411	Early Childhood Education	3
SPED 418	Alternative Curricular Approaches	3
SPED 419	Intensive Intervention in Reading	3
SPED 421	Intensive Intervention in Mathematics and Content Area Literacy	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
SPED 432	Positive Behavior Support	3
SPED 452	Assessment in Special Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
SPED 443	Special Education Student Teaching and Seminar	3

Master of Education in Special Education with Special Ed PreK-12 and General Ed 7-12 Certification

This 30 credit (minimum) master's program is designed for students seeking Pennsylvania certification as Special Education PreK-12 teachers (with General Education 7-12 dual certification eligibility).

SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 404	Cultural and Linguistic Diversity	3
SPED 411	Early Childhood Education	3
SPED 418	Alternative Curricular Approaches	3
SPED 419	Intensive Intervention in Reading	3
SPED 421	Intensive Intervention in Mathematics and Content Area Literacy	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
SPED 432	Positive Behavior Support	3
SPED 452	Assessment in Special Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3

NOTE: Students seeking dual certification in general education 7-12 and Special Education PreK-12 must complete an additional ten courses (30 credits) that are not listed above [including SPED 442, General Education and Special Education Student Teaching and Seminar]. These courses/credits are required to be eligible for dual certification but are not part of the master's program in Special Education.

Master of Education in Special Education with Special Ed PreK-12 and General Ed PreK-4 Certification

This 30 credit (minimum) master's program is designed for students seeking Pennsylvania certification as Special Education PreK-12 teachers (with General Education PreK-4 dual certification eligibility).

SPED 332	Introduction to Inclusion and Exceptional Education	3
SPED 404	Cultural and Linguistic Diversity	3
SPED 411	Early Childhood Education	3
SPED 418	Alternative Curricular Approaches	3
SPED 419	Intensive Intervention in Reading	3
SPED 421	Intensive Intervention in Mathematics and Content Area Literacy	3
SPED 423	Supporting Transition for Individuals with Disabilities	3
SPED 432	Positive Behavior Support	3
SPED 452	Assessment in Special Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3

NOTE: Students seeking dual certification in general education PreK-4 and Special Education PreK-12 must complete an additional ten courses (30 credits) that are not listed above [including SPED 442, General Education and Special Education Student Teaching and Seminar]. These courses/credits are required to be eligible for dual certification but are not part of the master's program in Special Education.

Master of Education in Behavior Analysis

The Master of Education (M.Ed.) degree in Behavior Analysis is designed for the college graduate who is interested in pursuing advanced studies in behavior analysis. Core courses have been designed to meet the Sixth Edition Task List and Foundational Knowledge List issued by the Behavior Analyst Certification Board® (BACB®). The mission of this master's program is to enhance the skills of practitioners in the field of special education by providing a concentration in evidence-based behavioral support strategies.

PROGRAM OF STUDY (30 credits)

Core Coursework (21 credits, core course sequence approved by the BACB®)		
The Behavior Analyst Certification Board, Inc.® (BACB®) has verified the following course sequence as meeting the coursework requirements for eligibility to take the Board Certified Behavior Analyst Examination®. Applicants will have to meet additional requirements to qualify (http://bacb.com/bcba-requirements/).		
SPED 408	Basic Principles of Behavior	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 422	Theory & Philosophy in Behavior Analysis	3
SPED 446	Research Methods in Behavior Analysis	3
SPED 454	Behavior Assessment	3
SPED 455	Intervention and Behavior Change	3
SPED 412	Organizational Behavior Management	3
Diversity Requirement (3 credits)		
SPED 404	Cultural and Linguistic Diversity	3
EDUC 471	Diversity and Multicultural Perspectives	3
Additional Courses (6 credits)		
SPED 418	Alternative Curricular Approaches	3
SPED 432	Positive Behavior Support	3
Other electives as approved by advisor		

Certificate in Behavior Analysis

A 21-credit Lehigh certificate program offered through the Special Education program. This certificate program provides a concentration of coursework in behavior analysis for practitioners interested in enhancing their knowledge and skills in implementing evidence-based behavioral support strategies. The Behavior Analyst Certification Board, Inc.® (BACB®) has approved the following course sequence as meeting the coursework requirements for eligibility to take the Board Certification Behavior Analyst Examination®. Applicants will have to meet additional requirements to qualify.*

SPED 408	Basic Principles of Behavior	3
SPED 410	Behavior Analysts: Ethics and Professional Conduct	3
SPED 412	Organizational Behavior Management	3
SPED 422	Theory & Philosophy in Behavior Analysis	3
SPED 446	Research Methods in Behavior Analysis	3
SPED 454	Behavior Assessment	3
SPED 455	Intervention and Behavior Change	3

*Please refer to http://bacb.com/bcba-requirements/ for additional requirements for eligibility to take the Board Certification Behavior Analyst Examination®. Those interested in taking the BCBA® exam must also have at least an acceptable master's degree from an accredited university and a defined period of supervised practical experience. If you are also interested in a master's degree, you may want to consider our Master of Education (M.Ed.) in Special Education offered through the Special Education Program.

Teaching English to Speakers of Other Languages (TESOL) Certificate

This certificate is committed to advancing educators' knowledge and use of evidence-based instructional practices to support the learning and second language development of second language learners. With the understanding that second language learners often have inequitable learning opportunities, this certificate program seeks to assist educators in being agents of social change in education through enhanced knowledge of linguistics and second language instructional practices.

- Three classes from the following: SPED/TLT 404, EDUC 391, 419, 420, or 423.
- One class from the following:
  - Any remaining eligible ESL courses (SPED/TLT 404, EDUC 391, 419, 420, or 423),
  - Any teacher education course from either the elementary or secondary certification track, or
  - Other courses as approved by advisor.

Courses

SPED 330 Special Topics in Special Education 1-3 Credits
Current issues in the education of individuals with special needs. Titles vary.
Repeat Status: Course may be repeated.

SPED 332 Introduction to Inclusion and Exceptional Education 3 Credits
Overview of social, developmental, legal, and educational issues and practices related to the special education of individuals with disabilities. Covers social, environmental, and physiological etiology; development; identification; learning characteristics; and needs of individuals identified for special education. Emphasizes meeting diverse needs of students in general education classrooms through evidence-based practices and adaptations matched to learner needs. Addresses legal rights of students and their families, as well as legal responsibilities of teachers as required by IDEIA and other related special legislation.

SPED 338 Emotional and Behavioral Disorders of Children 3 Credits
Definition, classification, etiology, treatment, and historical perspective of children and adolescent disorders.

SPED 402 (SCHP 402) Applied Behavior Analysis 3 Credits
Theory and application of behavior modification methods in classroom and clinical settings. Topics include behavior analysis, outcome research, task utilization, and single case research.

SPED 404 (TLT 404) Cultural and Linguistic Diversity 3 Credits
All teachers need to gain an understanding of how to support culturally and linguistically diverse students, particularly multilingual learners (MLs). This course explores the systemic disadvantage and bias MLs experience in the school system. It will offer best practices and concrete strategies that teachers can implement to challenge systemic disadvantages MLs face in classrooms and schools. With the understanding that students have complex identities and needs, throughout the course, the heterogeneity of culturally and linguistically diverse students will be emphasized.

SPED 405 (TLT 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

SPED 408 Basic Principles of Behavior 3 Credits
This course examines the core concepts of applied behavior analysis. Principles describing the influence of environmental events on behavior change and strategies that can be applied to make behavior change socially meaningful in school, home, and community settings will also be covered. Topics include respondent and operant conditioning, reinforcement, punishment, extinction, stimulus discrimination, motivation operations, verbal behavior, and imitation and observational learning.
Repeat Status: Course may be repeated.

SPED 409 (TLT 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a positive learning environment using evidence-based classroom management strategies for all learners, including students with disabilities and those from culturally and linguistically diverse backgrounds. Addresses function-based thinking to understand behavior problems and identify appropriate interventions. Includes discussion of manifestation of both internalizing and externalizing problems and related interventions.

SPED 410 Behavior Analysts: Ethics and Professional Conduct 3 Credits
This course is designed to provide students an in-depth review of the BACB Professional and Ethics Compliance Code for Behavior Analysts and other relevant content and readings that further support student understanding of the topic area. Class discussions, review of case studies, and student-lead small group problem-solving activities will enable students to apply ethical and professional standards to their work, further promoting quality interactions between the children and adults they serve, families, teachers, and others stakeholders.

SPED 411 (TLT 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

SPED 412 Organizational Behavior Management 3 Credits
This course provides an introduction to organizational behavior management (OBM). Students will learn how to assess work environments and implement function-based antecedent and consequent interventions with the goal of improving employee performance and business outcomes. Topics include performance analysis and management, supervision, staff training, behavioral systems analysis, organizational culture, and leadership. Through a review of relevant literature and case studies, students will learn how to approach complex ethical scenarios and promote a diverse, equitable, and inclusive organizational culture.
Repeat Status: Course may be repeated.

SPED 416 Autism Spectrum Disorders and Evidence-Based Practices 3 Credits
This course provides an overview of Autism Spectrum Disorders (ASD) and an introduction to the evidence based practices (EBPs) for practitioners, based on recently published and publicly available reports and other supporting materials. Assignments help students translate EBPs, grounded in Applied Behavior Analysis (ABA), into concrete goals and practices that have a meaningful impact on the day-to-day functioning of students with ASD.

SPED 418 Alternative Curricular Approaches 3 Credits
Curricular and instructional methods for students with pervasive support needs (e.g., intellectual disabilities, autism) who follow an alternative or modified curriculum. Methods for developing an individualized curriculum, embedding instruction and accessing the general education curriculum, systematic instruction, and instruction for full participation in school, home, and community settings are covered. Strategies for facilitating emergent social and communication skills, teaching augmentative and alternative communication, and use of assistive technologies to enhance self-directed learning are included.

SPED 419 Intensive Intervention in Reading 3 Credits
Methods course designed to address the needs of students with disabilities to increase knowledge of instruction of comprehensive pre-literacy and literacy skills and their components. Additionally, pre-reading, reading, language arts, mathematics, and content area reading literacy skills in primary and elementary settings will be addressed. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 420 Field Experience: Special Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching for special education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world settings, and aligning instruction with standards. Consent of program director required.
Repeat Status: Course may be repeated.

SPED 421 Intensive Intervention in Mathematics and Content Area Literacy 3 Credits
Methods course designed to increase knowledge of core components of reading in secondary settings, language arts, mathematics, and content area literacy skills for students with disabilities and those who are culturally and/or linguistically diverse. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments, modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 422 Theory & Philosophy in Behavior Analysis 3 Credits
This course will examine the field of human and animal learning, including operant and classical conditioning. The history and evolution of psychology and the science of behavior will be discussed. The course will provide a foundation for understanding the behaviorism of B. F. Skinner. In addition, the course will describe current applications of applied behavior analysis.
Repeat Status: Course may be repeated.

SPED 423 Supporting Transition for Individuals with Disabilities 3 Credits
Best instructional practices for preparing students for the early childhood transition into special education and the transition to post-school adult life: employment, post-secondary education, and community participation in inclusive settings. Topics include transition planning, person-centered and work-based assessments, family and interagency collaboration, innovative post-school and in-school transition services, and self-determination. Evidence-based practices to promote positive student outcomes are emphasized.

SPED 425 Applied Behavior Analysis Practicum 1-6 Credits
This practicum is designed to shape supervisee's clinical and behavioral skills as well as his/her professional, ethical, and collegial behavior. This experience embeds the concepts, principles, methods, and applications of behavior analysis learned in the course sequence and applies them to educational, clinical, and community/home settings.
Repeat Status: Course may be repeated.

SPED 427 Contemporary Service Delivery Models 3 Credits
This course is to provide students with knowledge and skills related to contemporary academic and behavioral service delivery models such as multi-tier systems of supports (MTSS). Relevant research literature will be explored to promote critical reflection on the models. Students will gain knowledge and skills in the following areas: (1) core components of service delivery models; (2) implementation of the services delivery model within k-12 schools; and (3) legal, ethical, and administrative issues related to service delivery implementation.

SPED 429 Professional Seminar 3 Credits
Master's seminar on current issues in the area of special education and research design. Must have 18 graduate credits in special education.

SPED 430 Advanced Seminar in Special Education 3 Credits
Advanced issues relating to the field of special education. Titles will vary.
Repeat Status: Course may be repeated.

SPED 432 Positive Behavior Support 3 Credits
Addresses tiered models of prevention and support. Includes design of comprehensive, multi-component behavior support plans for individuals with a variety of disabilities who engage in problem behavior. Emphasis on functional assessment and evidence-based interventions. Assessment focuses on the link between curriculum, academic performance, and behavior problems. Addresses mental health challenges, the role of various school-based professionals, and collaboration across agencies. Promotes consideration of diverse populations for understanding behavioral differences. Describes strategies for ongoing monitoring and maintenance of behavior reductions.

SPED 434 Applied Research Practicum 1-3 Credits
Designing and conducting research projects in applied settings.

SPED 440 Early Academic Intervention 3 Credits
Explores the potential effectiveness of interventions to prevent academic failure of children at risk for learning difficulties. Emphasis on research-based interventions in the areas of beginning reading, language and vocabulary, writing and spelling, awareness of print and exposure to print, and mathematics (number sense).

SPED 442 (TLT 442) General Education and Special Education Student Teaching and Seminar 4-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

SPED 443 Special Education Student Teaching and Seminar 3-4 Credits
Intensive practice in the application of principles of teaching for special education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world settings, and aligning instruction with standards. Consent of program director required.

SPED 446 Research Methods in Behavior Analysis 3 Credits
This course focuses on research methods in behavior analysis. Students will develop operational definitions and identify data collection methods. Students will learn basic single case experimental designs and how to assess internal and external validity. Students will analyze and interpret graphic data. Students will understand treatment integrity and social validity. Students will summarize and critically evaluate single case design research studies. Finally, students will describe ethical conduct in conducting research in school, home, and community settings to improve life quality.
Repeat Status: Course may be repeated.
Prerequisites: SPED 408
Can be taken Concurrently: SPED 408

SPED 452 Assessment in Special Education 3 Credits
Identification, administration and interpretation of a variety of assessments used for planning and to determine special education eligibility and to assess social, emotional, behavioral, and academic functioning. Discusses strengths and limitations of various models and assessment, both formal and informal, instruments used to evaluate the need for special education. Describes strategies to enhance the relationship between assessment and service delivery. Addresses assessment practices to identity curricular needs consistent with the RtII framework.

SPED 454 Behavior Assessment 3 Credits
This course focuses on behavior assessment. It covers descriptive and functional assessment of problematic behavior, as well as functional analysis. Students learn to conduct record review, determine the need for behavior analytic services, select socially significant behavior-change goals, and conduct skill and preference assessment. Through case studies, students learn to describe the common functions of behavior. Examples of multi-disciplinary applications of behavior assessment are presented.
Repeat Status: Course may be repeated.

SPED 455 Intervention and Behavior Change 3 Credits
This course teaches the application of behavior analytic principles across varied child, adult, and health contexts. Training is provided for procedures such as reinforcement, punishment, motivating operations, modeling, stimulus control, rules, shaping and chaining. Students explore methods for teaching simple to complex repertoires, using discrete trials, Skinner's analysis of verbal behavior, group contingencies, self-management, and strategies to maintain and generalize behavior. Topics include behavior change applications from a range of subject-matter experts across multiple uses of applied behavior analysis.
Repeat Status: Course may be repeated.
Prerequisites: SPED 454

SPED 465 Advanced Inclusionary Practices in K-12 3 Credits
Advanced techniques grounded in current research-based methods and best practice for educating and assessing students with disabilities, students from diverse backgrounds, and English language learners using a standards-aligned system. Accommodations, modifications, planning for physical and instructional inclusion through embedded strategic instruction, adaptations, and curriculum overlapping. Addresses decision hierarchies for level of instructional adaptation and social inclusion methods through social facilitation techniques. Explores critical factors in developing, implementing, and modifying curriculum using evidence-based practices. Explores collaborative co-planning and co-teaching models.
Prerequisites: SPED 332

SPED 482 Practicum in University Teaching: Special Education 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Special Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

SPED 490 Doctoral Seminar in Special Education 3 Credits
Advanced knowledge of issues and research in the education of individuals with special needs. Topics will vary. Must be admitted for doctoral studies.
Repeat Status: Course may be repeated.

SPED 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Teacher Preparation: Elementary and Secondary Education

Students seeking initial teacher certification may earn a Master of Education in Elementary Education with PreK-Grade 4 Teacher Certification or a Master of Education in Secondary Education with Grades 7-12 Teacher Certification. Students wishing to earn dual certification in both general education and special education may earn their master's degree and acquire such dual certification by completing additional courses in Special Education. Special education certification is PreK-12th grade. Students may also complete additional courses to add an English as a Second Language program specialist (PreK-12) certification or an endorsement in Social, Emotional and Behavioral Wellness.

Lehigh Undergraduate students are able to apply to the College of Education to take courses at the undergraduate level that will lead to a 4-year Bachelor's degree plus a Master's at the end of the fifth year. The Teaching, Learning, and Technology (TLT) Program offers a 4 + 1 accelerated Master's where students receive their Master of Education in Elementary Education and PreK-Grade 4 Certification or Master of Education in Secondary Education and Grades 7-12 Teacher Certification along with their undergraduate degree. After approval, undergraduates are permitted to take selected courses while completing their undergraduate degrees. Following graduation, in an additional year, these students complete the remaining coursework toward teacher certification and a Master's degree.

Lehigh undergraduates who did not participate in our 4+1 program, as well as students who have graduated from other institutions with at least a Bachelor's degree, may also earn their teacher certification as part of a Master's degree.

Courses toward initial teacher certification are taught by faculty from Teaching, Learning, and Technology Program and the Special Education Program. Our preparation programs highlight evidence-based, strengths-focused, and technology-enabled strategies to reach all learners. We emphasize collaborative and equitable approaches to instruction and learning.

Lehigh's College of Education is accredited by the Pennsylvania Department of Education (PDE) to offer 10 teacher certifications along with the ESL Program Specialist PK-12 and the Social Emotional Behavioral Wellness endorsement:

- Elementary Education (Grades PreK-4);
- Eight Secondary (7th-12th grade) certifications: Biology, Chemistry, Earth and Space Science, English, General Science, Mathematics, Physics, and Social Studies; and
- Additional certifications and endorsements may be earned, at the same time and/or after students earn their general education certification: Special Education PreK-12 certification; English as a Second Language program specialist PreK-12 certification; Social, Emotional and Behavioral Wellness.

Pennsylvania has signed an Interstate Agreement with most other states/jurisdictions based upon mutually agreed-upon conditions. The contract provides for acceptance of state-approved educator preparation programs between certain states to facilitate educator mobility.

The College of Education also has relationships with international schools all over the world, enabling new teacher graduates to pursue teaching opportunities abroad.

For additional information about the program, please visit: http://coe.lehigh.edu/academics/disciplines/teachered

4+1 Bachelor's Plus Accelerated Master of Education in Elementary Education and PreK-4 Certification

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:

B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master's program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

Core Course Work (21 credit hours)

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 380	Child Development and Cognition	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3

TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3
TLT 411	Early Childhood Education	3

Development of Professional Skills (18 credit hours)

TLT 412	Social Studies in PreK through 4th Grade	3
TLT 420	Literacy in PreK through 4th Grade: Reading and Its Foundations	3
TLT 422	Literacy in PreK through 4th Grade: Writing and Its Foundations	3
TLT 426	Science in PreK through 4th Grade	3
TLT 428	Mathematics and Numeracy in PreK through 4th Grade	3
SPED 465	Advanced Inclusionary Practices in K-12	3

Extended Field Experience (3-6 credit hours)

TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (3 credit hours)

Senior Year (12 credit hours)

College of Education - Summer (12 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in the 5-year program will take 18 credits pre-bachelor's and an additional 27 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

4+1 BACHELOR'S PLUS ACCELERATED MASTER OF EDUCATION IN SECONDARY EDUCATION AND TEACHER CERTIFICATION

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

PROGRAM OF STUDY:

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor's degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:

Core Coursework (15 credits)

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3

Development of Professional Skills (12 credits)

Content-area teaching methods course with approval of adviser (one of the following):		
TLT 431	Social Studies in Middle Level and High School Education	3
TLT 434	English in Middle Level and High School Education	3
TLT 436	Science in Middle Level and High School Education	3
TLT 438	Mathematics in Middle Level and High School Education	3
Plus:		
TLT 432	Reading and Critical Thinking in Middle Level and High School Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
TLT XXX Elective with adviser approval		3

Extended Field Experiences (6-9 credits)

TLT 440	Pre-professional Seminar	3
TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (6 credit hours)

Senior Year (6 credit hours)

College of Education - Summer (6 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

Master of Education in Elementary Education and PreK-4 Teacher Certification

This 42-credit (minimum) program prepares students for Pennsylvania Level I certification as PreK-4 teachers and leads to the awarding of a master's degree in Elementary Education. Students complete coursework in three categories:

Core Course Work (21 credit hours)

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 380	Child Development and Cognition	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3
TLT 411	Early Childhood Education	3

Development of Professional Skills (18 credit hours)

TLT 412	Social Studies in PreK through 4th Grade	3
TLT 420	Literacy in PreK through 4th Grade: Reading and Its Foundations	3
TLT 422	Literacy in PreK through 4th Grade: Writing and Its Foundations	3
TLT 426	Science in PreK through 4th Grade	3
TLT 428	Mathematics and Numeracy in PreK through 4th Grade	3
SPED 465	Advanced Inclusionary Practices in K-12	3

Extended Field Experience (3 credit hours)

TLT 444	General Education Student Teaching and Seminar	1-6

Thirty (30) credits minimum is required for the master's degree. In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification (English, mathematics, science, social studies). At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas (language arts, mathematics, science and social studies). The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

Master of Education in Secondary Education and Teacher Certification

This 33 credit (minimum) program of study prepares students for Pennsylvania Level I certification as secondary content-area teachers in one of the subject areas (below) and leads to eligibility for a master's degree in secondary education:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

Students complete coursework in three categories:

Core Coursework (15 credit hours)

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3

Development of Professional Skills (12 credit hours)

Content-area teaching methods course with approval of your adviser (one of the following):		
TLT 431	Social Studies in Middle Level and High School Education	3
TLT 434	English in Middle Level and High School Education	3
TLT 436	Science in Middle Level and High School Education	3
TLT 438	Mathematics in Middle Level and High School Education	3
Plus:		
TLT 432	Reading and Critical Thinking in Middle Level and High School Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
TLT XXX Elective with adviser approval		3

Extended Field Experiences (6 credit hours)

TLT 440	Pre-professional Seminar	3
TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter are of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Special Education Courses

SPED 330 Special Topics in Special Education 1-3 Credits
Current issues in the education of individuals with special needs. Titles vary.
Repeat Status: Course may be repeated.

SPED 332 Introduction to Inclusion and Exceptional Education 3 Credits
Overview of social, developmental, legal, and educational issues and practices related to the special education of individuals with disabilities. Covers social, environmental, and physiological etiology; development; identification; learning characteristics; and needs of individuals identified for special education. Emphasizes meeting diverse needs of students in general education classrooms through evidence-based practices and adaptations matched to learner needs. Addresses legal rights of students and their families, as well as legal responsibilities of teachers as required by IDEIA and other related special legislation.

SPED 338 Emotional and Behavioral Disorders of Children 3 Credits
Definition, classification, etiology, treatment, and historical perspective of children and adolescent disorders.

SPED 402 (SCHP 402) Applied Behavior Analysis 3 Credits
Theory and application of behavior modification methods in classroom and clinical settings. Topics include behavior analysis, outcome research, task utilization, and single case research.

SPED 404 (TLT 404) Cultural and Linguistic Diversity 3 Credits
All teachers need to gain an understanding of how to support culturally and linguistically diverse students, particularly multilingual learners (MLs). This course explores the systemic disadvantage and bias MLs experience in the school system. It will offer best practices and concrete strategies that teachers can implement to challenge systemic disadvantages MLs face in classrooms and schools. With the understanding that students have complex identities and needs, throughout the course, the heterogeneity of culturally and linguistically diverse students will be emphasized.

SPED 405 (TLT 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

SPED 408 Basic Principles of Behavior 3 Credits
This course examines the core concepts of applied behavior analysis. Principles describing the influence of environmental events on behavior change and strategies that can be applied to make behavior change socially meaningful in school, home, and community settings will also be covered. Topics include respondent and operant conditioning, reinforcement, punishment, extinction, stimulus discrimination, motivation operations, verbal behavior, and imitation and observational learning.
Repeat Status: Course may be repeated.

SPED 409 (TLT 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a positive learning environment using evidence-based classroom management strategies for all learners, including students with disabilities and those from culturally and linguistically diverse backgrounds. Addresses function-based thinking to understand behavior problems and identify appropriate interventions. Includes discussion of manifestation of both internalizing and externalizing problems and related interventions.

SPED 410 Behavior Analysts: Ethics and Professional Conduct 3 Credits
This course is designed to provide students an in-depth review of the BACB Professional and Ethics Compliance Code for Behavior Analysts and other relevant content and readings that further support student understanding of the topic area. Class discussions, review of case studies, and student-lead small group problem-solving activities will enable students to apply ethical and professional standards to their work, further promoting quality interactions between the children and adults they serve, families, teachers, and others stakeholders.

SPED 411 (TLT 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

SPED 412 Organizational Behavior Management 3 Credits
This course provides an introduction to organizational behavior management (OBM). Students will learn how to assess work environments and implement function-based antecedent and consequent interventions with the goal of improving employee performance and business outcomes. Topics include performance analysis and management, supervision, staff training, behavioral systems analysis, organizational culture, and leadership. Through a review of relevant literature and case studies, students will learn how to approach complex ethical scenarios and promote a diverse, equitable, and inclusive organizational culture.
Repeat Status: Course may be repeated.

SPED 416 Autism Spectrum Disorders and Evidence-Based Practices 3 Credits
This course provides an overview of Autism Spectrum Disorders (ASD) and an introduction to the evidence based practices (EBPs) for practitioners, based on recently published and publicly available reports and other supporting materials. Assignments help students translate EBPs, grounded in Applied Behavior Analysis (ABA), into concrete goals and practices that have a meaningful impact on the day-to-day functioning of students with ASD.

SPED 418 Alternative Curricular Approaches 3 Credits
Curricular and instructional methods for students with pervasive support needs (e.g., intellectual disabilities, autism) who follow an alternative or modified curriculum. Methods for developing an individualized curriculum, embedding instruction and accessing the general education curriculum, systematic instruction, and instruction for full participation in school, home, and community settings are covered. Strategies for facilitating emergent social and communication skills, teaching augmentative and alternative communication, and use of assistive technologies to enhance self-directed learning are included.

SPED 419 Intensive Intervention in Reading 3 Credits
Methods course designed to address the needs of students with disabilities to increase knowledge of instruction of comprehensive pre-literacy and literacy skills and their components. Additionally, pre-reading, reading, language arts, mathematics, and content area reading literacy skills in primary and elementary settings will be addressed. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 420 Field Experience: Special Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching for special education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world settings, and aligning instruction with standards. Consent of program director required.
Repeat Status: Course may be repeated.

SPED 421 Intensive Intervention in Mathematics and Content Area Literacy 3 Credits
Methods course designed to increase knowledge of core components of reading in secondary settings, language arts, mathematics, and content area literacy skills for students with disabilities and those who are culturally and/or linguistically diverse. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments, modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 422 Theory & Philosophy in Behavior Analysis 3 Credits
This course will examine the field of human and animal learning, including operant and classical conditioning. The history and evolution of psychology and the science of behavior will be discussed. The course will provide a foundation for understanding the behaviorism of B. F. Skinner. In addition, the course will describe current applications of applied behavior analysis.
Repeat Status: Course may be repeated.

SPED 423 Supporting Transition for Individuals with Disabilities 3 Credits
Best instructional practices for preparing students for the early childhood transition into special education and the transition to post-school adult life: employment, post-secondary education, and community participation in inclusive settings. Topics include transition planning, person-centered and work-based assessments, family and interagency collaboration, innovative post-school and in-school transition services, and self-determination. Evidence-based practices to promote positive student outcomes are emphasized.

SPED 425 Applied Behavior Analysis Practicum 1-6 Credits
This practicum is designed to shape supervisee's clinical and behavioral skills as well as his/her professional, ethical, and collegial behavior. This experience embeds the concepts, principles, methods, and applications of behavior analysis learned in the course sequence and applies them to educational, clinical, and community/home settings.
Repeat Status: Course may be repeated.

SPED 427 Contemporary Service Delivery Models 3 Credits
This course is to provide students with knowledge and skills related to contemporary academic and behavioral service delivery models such as multi-tier systems of supports (MTSS). Relevant research literature will be explored to promote critical reflection on the models. Students will gain knowledge and skills in the following areas: (1) core components of service delivery models; (2) implementation of the services delivery model within k-12 schools; and (3) legal, ethical, and administrative issues related to service delivery implementation.

SPED 429 Professional Seminar 3 Credits
Master's seminar on current issues in the area of special education and research design. Must have 18 graduate credits in special education.

SPED 430 Advanced Seminar in Special Education 3 Credits
Advanced issues relating to the field of special education. Titles will vary.
Repeat Status: Course may be repeated.

SPED 432 Positive Behavior Support 3 Credits
Addresses tiered models of prevention and support. Includes design of comprehensive, multi-component behavior support plans for individuals with a variety of disabilities who engage in problem behavior. Emphasis on functional assessment and evidence-based interventions. Assessment focuses on the link between curriculum, academic performance, and behavior problems. Addresses mental health challenges, the role of various school-based professionals, and collaboration across agencies. Promotes consideration of diverse populations for understanding behavioral differences. Describes strategies for ongoing monitoring and maintenance of behavior reductions.

SPED 434 Applied Research Practicum 1-3 Credits
Designing and conducting research projects in applied settings.

SPED 440 Early Academic Intervention 3 Credits
Explores the potential effectiveness of interventions to prevent academic failure of children at risk for learning difficulties. Emphasis on research-based interventions in the areas of beginning reading, language and vocabulary, writing and spelling, awareness of print and exposure to print, and mathematics (number sense).

SPED 442 (TLT 442) General Education and Special Education Student Teaching and Seminar 4-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

SPED 443 Special Education Student Teaching and Seminar 3-4 Credits
Intensive practice in the application of principles of teaching for special education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world settings, and aligning instruction with standards. Consent of program director required.

SPED 446 Research Methods in Behavior Analysis 3 Credits
This course focuses on research methods in behavior analysis. Students will develop operational definitions and identify data collection methods. Students will learn basic single case experimental designs and how to assess internal and external validity. Students will analyze and interpret graphic data. Students will understand treatment integrity and social validity. Students will summarize and critically evaluate single case design research studies. Finally, students will describe ethical conduct in conducting research in school, home, and community settings to improve life quality.
Repeat Status: Course may be repeated.
Prerequisites: SPED 408
Can be taken Concurrently: SPED 408

SPED 452 Assessment in Special Education 3 Credits
Identification, administration and interpretation of a variety of assessments used for planning and to determine special education eligibility and to assess social, emotional, behavioral, and academic functioning. Discusses strengths and limitations of various models and assessment, both formal and informal, instruments used to evaluate the need for special education. Describes strategies to enhance the relationship between assessment and service delivery. Addresses assessment practices to identity curricular needs consistent with the RtII framework.

SPED 454 Behavior Assessment 3 Credits
This course focuses on behavior assessment. It covers descriptive and functional assessment of problematic behavior, as well as functional analysis. Students learn to conduct record review, determine the need for behavior analytic services, select socially significant behavior-change goals, and conduct skill and preference assessment. Through case studies, students learn to describe the common functions of behavior. Examples of multi-disciplinary applications of behavior assessment are presented.
Repeat Status: Course may be repeated.

SPED 455 Intervention and Behavior Change 3 Credits
This course teaches the application of behavior analytic principles across varied child, adult, and health contexts. Training is provided for procedures such as reinforcement, punishment, motivating operations, modeling, stimulus control, rules, shaping and chaining. Students explore methods for teaching simple to complex repertoires, using discrete trials, Skinner's analysis of verbal behavior, group contingencies, self-management, and strategies to maintain and generalize behavior. Topics include behavior change applications from a range of subject-matter experts across multiple uses of applied behavior analysis.
Repeat Status: Course may be repeated.
Prerequisites: SPED 454

SPED 465 Advanced Inclusionary Practices in K-12 3 Credits
Advanced techniques grounded in current research-based methods and best practice for educating and assessing students with disabilities, students from diverse backgrounds, and English language learners using a standards-aligned system. Accommodations, modifications, planning for physical and instructional inclusion through embedded strategic instruction, adaptations, and curriculum overlapping. Addresses decision hierarchies for level of instructional adaptation and social inclusion methods through social facilitation techniques. Explores critical factors in developing, implementing, and modifying curriculum using evidence-based practices. Explores collaborative co-planning and co-teaching models.
Prerequisites: SPED 332

SPED 482 Practicum in University Teaching: Special Education 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Special Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

SPED 490 Doctoral Seminar in Special Education 3 Credits
Advanced knowledge of issues and research in the education of individuals with special needs. Topics will vary. Must be admitted for doctoral studies.
Repeat Status: Course may be repeated.

SPED 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Teaching Learning Technology Courses

TLT 367 (EVST 367) Environmental Education 3 Credits
Introductory environmental education course designed to prepare students to implement environmental education opportunities in formal and non-formal education settings. Topics include history and philosophy of environmental education, environmental laws and regulations, GIS, environmental issues and decision making, curriculum integration and environmental education teaching methodologies. This is a Web enhanced containing both online and fieldwork components.

TLT 368 (EVST 368) Teaching and Learning with Geospatial Tools 3 Credits
Exploration of geospatial tools, including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth). Application of these tools and techniques to instructional settings, including appropriate pedagogy and assessment. Not available for credit for students who have completed EVST/TLT 369.

TLT 369 (EVST 369) Applied Geospatial Tools 3 Credits
Introduction to geospatial tools--including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth)--and related concepts such as geo-databases, map projection, and remote sensing. Application of these tools and techniques to research, policy, business, public health, and communications. Not available to students who have taken EVST/TLT 368.

TLT 371 The Business, Social, and Education Entrepreneur 3 Credits
Release your inner entrepreneur! This course offers an introduction to entrepreneurial thinking and action as applied to an innovative startup business, school initiative, or non-profit institution. The course is fully online, with asynchronous and synchronous sessions. Students will learn from case study exemplars across many fields that demonstrate the roles of creativity, planning, funding, and perseverance. Participants will learn by preparing a startup plan, writing sections throughout the course as the topics are studied.

TLT 380 Child Development and Cognition 3 Credits
Introduction to physical, motor, perceptual, cognitive, language, emotional, social, and gender development of young children and adolescents. Developmental history, theories, and research, as well as the effect of culture, family, peers, media, and schooling on the individual and groups. Students investigate typical and atypical development and explore the implications of individual differences for teaching and learning, with an emphasis on evidence-based instructional practices designed to optimize the growth and development of all learners. Explores mental health issues and at-risk students.

TLT 391 Workshops 1-3 Credits
Cooperative study of current educational problems. Provides elementary, secondary, and special education teachers an opportunity to work at their own teaching levels and in their own fields. Limited to six credits during a summer session but the student may register for more than one workshop provided there is no duplication in subject matter.
Repeat Status: Course may be repeated.

TLT 394 Special Topics in Education: 1-3 Credits
Examination of a topic of research or professional interest in education. Subtitle will vary. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

TLT 401 Overview of Teaching and Learning 3 Credits
Foundations and key concepts in learning and instructional theory. Cognition and brain-based research with a focus on innovations in teaching and learning.

TLT 402 Reading and Writing for Research Publication 3 Credits
Using literature to build persuasive written arguments. Searching and identifying promising sources, distilling research findings, synthesizing literature to support an argument, and organizing written materials to enhance persuasiveness. Suited to those writing qualifying projects, dissertation proposals, dissertations, funding proposals, conference proposals, and journal articles.

TLT 403 Introduction to Instructional Design 3 Credits
Social, cognitive, and environmental factors in designing for teaching and learning. Systems theory applied to learning settings. Special emphasis on motivational theories and technological affordances.

TLT 404 (SPED 404) Cultural and Linguistic Diversity 3 Credits
All teachers need to gain an understanding of how to support culturally and linguistically diverse students, particularly multilingual learners (MLs). This course explores the systemic disadvantage and bias MLs experience in the school system. It will offer best practices and concrete strategies that teachers can implement to challenge systemic disadvantages MLs face in classrooms and schools. With the understanding that students have complex identities and needs, throughout the course, the heterogeneity of culturally and linguistically diverse students will be emphasized.

TLT 405 (SPED 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

TLT 407 Instructional Design for K-12 Classrooms 3 Credits
Introduces the systematic design of instruction following the Response to Instruction and Intervention (RtII) and Universal Design for Learning models. Explores theories of learning and instructional applications as a part of technology-based and standards-aligned classroom education grounded in the use of a quality, research-based core curriculum and effective instructional practices to meet the needs of all learners. Addresses appropriate use of instructional technologies for universal learning. Students will plan, design, and develop student-centered, standards-aligned, technology-supported instruction and appropriate learner assessments.

TLT 409 (SPED 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a positive learning environment using evidence-based classroom management strategies for all learners, including students with disabilities and those from culturally and linguistically diverse backgrounds. Addresses function-based thinking to understand behavior problems and identify appropriate interventions. Includes discussion of manifestation of both internalizing and externalizing problems and related interventions.

TLT 410 The Writing Process 3 Credits
Developmental characteristics of children's writing and relationships among writing, spelling and reading. Predictors of writing achievement, teaching strategies and activities, and evaluation schemes will be emphasized, K-12.

TLT 411 (SPED 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

TLT 412 Social Studies in PreK through 4th Grade 3 Credits
Overview of Pennsylvania's PreK-4 Standards for social studies, including: Pennsylvania history, United States history, economics, civics and government, citizenship, political science/government, and geography. Development, implementation and evidence-based assessment of preK-grade 4 social studies curricula. Effective teaching techniques such as lesson planning, inclusive practices, integrating instructional technologies into instruction, reflecting on teaching, and the latest research-based teaching and assessment methods. Emphasis on alignment of instruction with standards.

TLT 420 Literacy in PreK through 4th Grade: Reading and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach reading and early reading skills in PreK-4th grade. Understanding of the skills of successful readers. Evidence-based practices in reading instruction and data-based decision-making to teach reading to all students, including students with disabilities and English learners. Strategies to partner with caregivers to enhance reading an early reading skills.

TLT 422 Literacy in PreK through 4th Grade: Writing and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach writing and foundational skills in PreK-4. Understanding of the developmental aspects of writing and the skills of successful writers. Evidence-based practices in writing instruction and data-based decision-making to teach writing to all students, including students with disabilities and English learners.

TLT 424 Children's Literature in Elementary Education 3 Credits
Role of literature in the instructional program of the elementary schools. Use of trade books for individualized instruction in reading, language arts, mathematics, science, and social studies.

TLT 426 Science in PreK through 4th Grade 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in preK-grade 4 classrooms. Emphasis on Pennsylvania's PreK-4 Standards for Science and Technology and Environment and Ecology standards and aligning instruction with standards. activities include planning effective lessons, trying out new methods of teaching, reflective practice, inclusionary methods, and integrating instructional technologies into science learning. Evidence-based assessment types are highlighted within instructional contexts.

TLT 428 Mathematics and Numeracy in PreK through 4th Grade 3 Credits
Trends, theories, activities and manipulative materials for teaching early numeracy and elementary mathematics. Pre-school development and in-school skills and concepts, including sets, systems of numeration, experience with numbers, number operations and concepts, numerals, measurement, early algebra, and elements of geometry. Implications of developmental differences and early non-school experiences on learner readiness and skills. Helping parents support their children's mathematics conceptual development. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across ability levels.

TLT 431 Social Studies in Middle Level and High School Education 3 Credits
Middle and high school curriculum, content, teaching strategies, and instructional materials for the social studies. Emphasis on organizing content, using appropriate methods, testing and evaluation, and appropriate integration of technology. Overview of Pennsylvania's 4-8 and 8-12 standards for social studies and related standards from the National Council for the Social Studies and other national organizations. Explores relevant research, courses of study, textbooks, and teacher-made materials. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 432 Reading and Critical Thinking in Middle Level and High School Education 3 Credits
Development of reading in the secondary content areas (English/language arts, mathematics, science, social studies). Highlights effective teaching strategies in critical areas, such as higher order reading and study skills. Addresses analysis of evidence based methods and current research for improving the reading development and analytical skills of all students.

TLT 434 English in Middle Level and High School Education 3 Credits
Curricula, philosophy, methods, strategies, and materials for the teaching of middle and high school English. Literature, genres, and the nature of text and text differences. Critical analysis and drawing inferences from narrative text and poetry. Techniques for teaching and enhancing writing in various styles. Applications of technology and assessment principles. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 436 Science in Middle Level and High School Education 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in secondary science classrooms. Emphasis on aligning instruction with Pennsylvania's Standards for Science and Technology and Environment and Ecology standards. activities include planning effective lessons, trying out new methods of teaching, inclusionary methods, reflective practice, and integrating instructional technologies into science learning. Evidence-based assessment types highlighted within instructional contexts.

TLT 438 Mathematics in Middle Level and High School Education 3 Credits
Standards-based and technology-intensive curricula, instructional activities, and manipulative aids for mathematics in middle level and high schools. This course models and explores an investigative and hands-on approach to secondary mathematics instruction. Particular attention given to learning theories, curriculum issues, and recommendations arising from state, national, and international assessments. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across a range of abilities. Addresses standards-aligned instructional approaches and techniques, including co-teaching.

TLT 440 Pre-professional Seminar 3 Credits
Study, directed observation of, and initial practice in the various phases of teaching in secondary schools. Guided opportunities to try out strategies to facilitate the inclusion of special education students, differentiated instructional practices, and standards-aligned and evidence-based instructional approaches in actual school settings. Consent of program coordinator required.

TLT 442 (SPED 442) General Education and Special Education Student Teaching and Seminar 4-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 444 General Education Student Teaching and Seminar 3-6 Credits
Intensive practice in the application of principles of teaching for general education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 450 Introduction to Learning Analytics 3 Credits
Data-informed decision-making is essential for improving teaching and learning practices. This course is designed for anyone interested in using data to improve education and learning outcomes. This course will provide you with the skills and knowledge necessary to succeed in the growing field of learning analytics. This course covers the basics of learning analytics (LA), including LA concepts, models, frameworks, and techniques. We will also discuss key ethical considerations in LA, including privacy, security, and bias.

TLT 451 Data Visualization 3 Credits
Educators are currently expected to comprehend, process, and handle large quantities of datasets with a variety of data types. In this course, learners will be provided with opportunities to learn the concepts and skills of data visualization, manage real-life data visualization tasks, interpret visualization outcomes, and enhance their understanding of data-driven decision-making.

TLT 454 Applied Instructional and Learning Design Principles 3 Credits
Exploration and application of design models for learning. Special emphasis on the application of teaching and learning theories and instructional design strategies and models to design and develop authentic learning products or experiences, iterate projects, and reflect on personal preferences and processes as designers.
Prerequisites: TLT 403

TLT 456 Instructional Design and Development Studio 3 Credits
Studio-based, authentic and collaborative design experiences led by a faculty mentor. Students work in teams to complete substantial multimedia design and development projects.
Prerequisites: TLT 454 and TLT 460

TLT 458 Introduction to Multimedia Programming and Development 3 Credits
Introduction to programming and resource development tools used in the creation of interactive multimedia teaching and learning materials.

TLT 460 Advanced Multimedia Programming and Development 3 Credits
Advanced exploration of programming and resource development tools used in the creation of interactive teaching and learning materials.
Prerequisites: TLT 458

TLT 461 Artificial Intelligence and Machine Learning for Education 3 Credits
Most educated people are mystified by artificial intelligence and machine learning. This course demystifies these emerging technologies through simple theory and hands-on experience. We will build AI and machine learning systems and apply them to tasks in teaching, learning, and administration. We will compare our understanding of machine learning with human learning, and we will extrapolate the state of technology today to the changes we can expect to see in the near future in education, economics (jobs), and daily life.

TLT 462 Special Topics in Teaching, Learning, and Technology 1-3 Credits
We know the field of teaching, learning, and technology is evolving at a rapid pace. This course focuses on innovations in teaching, learning, and technology.
Repeat Status: Course may be repeated.

TLT 463 Building Makerspaces for Learning 3 Credits
A Makerspace is both a space and a mindset. By encouraging play, design, tinkering, and creative inquiry, these spaces and mindsets can create transferable, high-order thinking skills, knowledge, and attitudes/beliefs about many topics. This course will discuss the fundamentals of why, what, where, and how to build and incorporate different types and "levels" of Makerspaces into any instructional setting.

TLT 464 Digital Storytelling 3 Credits
The art and practice of storytelling is assuredly almost as old as the advent of formal language itself, and for nearly all of that time, with few exceptions individual storytellers have been bounded within an analog framework. Recently, various digital tools have emerged (or have become more accessible) that facilitate digital storytelling, implications of which are potentially wide-ranging for technologists, educators, and students alike. This course will critically examine the comparatively nascent world of digital storytelling. We will first consider.

TLT 465 Design Thinking for Learning 3 Credits
In this project- and theory-based course, students will apply elements of design thinking to the development and production of curricular and instructional materials that support audience learning, engagement, and performance. Students will demonstrate knowledge, skills, and appropriate attitudes/beliefs [KSABs] in the design and development of a course-long project, group design challenge, and several project-based activities throughout the semester.

TLT 466 Field Experience: General Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching in general education in a supervised experience in the schools for students who already hold special education certification. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of the program director.

TLT 467 Project-, Scenario-, & Simulation-Based Learning in Interactive Multimedia Environments 3 Credits
This course focuses on the design, development, and implementation of authentic project-, scenario-, and simulation-based learning environments using interactive media. Students will apply various instructional design models, learning theories, and multimedia tools to create project-, scenario-, and simulation-based materials, visuals, and other digital media and assess the results. Students will explore story, character, and challenge design, choice creation, and consequence feedback loops to develop classroom or corporate, online, and mobile interactive learning environments.

TLT 468 Game-Based Learning 3 Credits
Learning games are designed through a combination of instructional and motivational design principles. Through playful, hands-on experiences, this course will address the theory, practice, and development of learning games in education. Participants will produce and test student-developed learning games.

TLT 469 Applied Artificial Intelligence and Machine Learning for Education 3 Credits
This course provides a comprehensive introduction to machine learning and its applications in the field of education. Through hands-on activities and practical explorations, students will gain the knowledge and skills to explore how machine learning can be used to improve teaching, learning, and assessment.

TLT 470 Technology for Teaching and Learning 3 Credits
Analysis of available technologies (hardware, software, and Web resources), and identification of technologies matched to learner needs in traditional and/or non-traditional settings.

TLT 472 Online Teaching and Learning 3 Credits
Examination of contemporary research on online learning and recognized best practices on the design and delivery of online, hybrid, and/or flipped courses or course modules. Emphasis on online activities to experience ways to maximize instructor presence and student engagement, collaboration, and achievement.

TLT 474 Large-scale Planning and Implementation of Educational Technology 3 Credits
Addresses topics such as planning, maintaining, funding, networking, staffing, staff development, and monitoring of educational technology implementations.

TLT 475 Trends and Innovations in Instructional Technology 3 Credits
Examination of current research and emerging trends in instructional technology with the goal of anticipating the development and diffusion of new practices in schools and school systems. As William Gibson famously said, “The future is here today, it’s just not evenly distributed.”

TLT 476 Assessment of Instructional Technologies 3 Credits
Techniques for evaluating technology implementations for teaching and learning. Focus on topics such as instrumentation, data collection and analysis, drawing conclusions from data sets, and preparing reports for stakeholders.

TLT 477 Cognitive Theory and Technology Integration 3 Credits
The spread of instructional technology systems and expanding knowledge of how we think and how learn has changed the ground beneath educators' feet. This course provides teachers with practical examples and frameworks for applying cognitive science and technology to benefit students through increased engagement, increased formative evaluation, and more.

TLT 478 School Leadership in the Digital Age 3 Credits
Successful implementation of any initiative in schools is contingent on support from leadership, whether it be administrators or teacher leaders. This course will focus on the characteristics of good leadership and how they may be applied in successful technology integration strategies. Concepts will be explored around creating an environment of equity through digital access, being a champion for personalized learning, and building a collaborative ecosystem of support.

TLT 479 Technology Integration Coaching 3 Credits
Instructional technology coaches work collaboratively with peer teachers to improve teaching, with a focus on the appropriate and effective uses of educational technologies. Practices include identifying a baseline of practices and habits of mind, setting meaningful goals for integration based on resources and student needs, assisting teachers in developing technology literacy, aiding teachers in integration, and providing ongoing support for success. This course will investigate the basic tenets of instructional coaching and then delve into evidence-based strategies for content-area instruction.

TLT 480 Curriculum Theory and Design 3 Credits
Curricular models and their features, with a focus on curriculum development and enactment. Special emphasis on design principles, curriculum’s role in K-12 settings, and technology-enhanced curriculum.

TLT 482 Practicum in University Teaching: Teaching, Learning & Technology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Teaching, Learning and Technology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

TLT 483 Diversity and Multicultural Perspectives in International Education 3 Credits
Examination of the influence of culture, gender, and disabilities on behavior and attitudes. Historical and current perspectives on race,culture, gender, sexual orientation, gender identity diversity, and minority group issues in education and psychology. The primary context of application is contemporary international education.

TLT 486 Doctoral Research Project I: Design & Development 3 Credits
This course provides students with the opportunity to design and develop research studies under the supervision of specific faculty.
Repeat Status: Course may be repeated.

TLT 487 Doctoral Research Project II: Implementation, Analysis, & Writing 3 Credits
This course provides students with the opportunity to implement, analyze, and write-up research studies under the supervision of specific faculty.
Repeat Status: Course may be repeated.

TLT 492 Classroom Research Methods 3 Credits
Introduces students to classroom research design paradigms and the assumptions behind them, use of the literature, developing research questions, qualitative and quantitative procedures, research design, sampling design, data collection, data analysis, and reporting research results using educational applications.

TLT 494 Culminating Research Project 3 Credits
Designing and conducting research projects in classroom settings.

TLT 499 Dissertation 1-15 Credits

Teaching, Learning, and Technology

Teaching, Learning, and Technology (TLT) Program offers four master's degrees and two graduate certificates, focused in two primary areas: teacher education and instructional technology/learning design. The program also offers a doctoral degree.

The master's degrees in preservice teacher education are Master of Education in Elementary Education and PreK-Grade 4 Teacher Certification, Master of Education in Secondary Education and Grades 7-12 Teacher Certification. Undergraduate students at Lehigh may also enroll in the 4 + 1 accelerated Master's where they receive their Master of Education in Elementary Education and PreK-Grade 4 Certification or Master of Education in Secondary Education and Grades 7-12 Teacher Certification, in addition to their Bachelor's degree. Teacher education students may elect to extend their coursework to earn additional certification/endorsement in Special Education, English as a Second Language program specialist PreK-12, and/or Social-Emotional-Behavioral Wellness endorsement. All teacher certification programs have been approved by the Pennsylvania Department of Education, making graduates eligible for initial certification in Pennsylvania.

For in-service teachers or individuals seeking to learn how to educate in informal contexts, TLT offers several Master's degrees and certificates:

The Master of Education in Teaching and Learning prepares educators (broadly defined) who want to learn the foundations of teaching and learning as well as innovative pedagogical strategies. This degree can be customized to a particular area of emphasis, such as technology and design, innovative pedagogy, English as a Second Language, or social-emotional-behavioral wellness.

TLT also offers a Master of Science in Instructional Technology which prepares educators (broadly defined) to integrate instructional technology more effectively in a variety of contexts.

Certificates (12 credits) are also available in: Learning Design in Schools and Professional Settings as well as Game-Based Learning.

Finally, the program offers a Doctor of Philosophy in Teaching, Learning, and Technology, which spans fields of learning design, instructional technology, and teacher education.

The TLT program prepares professional educators, technologists, and designers through a combination of graduate-level education and certification experiences. The program highlights research-based, inquiry-oriented, and technology-enabled strategies to reach all learners. We emphasize collaborative and equitable approaches to instruction and learning. TLT graduates are scholars, highly skilled practitioners, and leaders in their professional communities.

Upon completion, TLT graduates become teachers in PreK-12 schools; curriculum coordinators, coaches, and educational technology specialists in both formal and informal education settings; instructional or learning designers and/or technologists; or faculty in higher education institutions.

For more information about our Master's Degrees:

https://ed.lehigh.edu/academics/degrees/masters-degrees (https://ed.lehigh.edu/academics/degrees/masters-degrees/)

For more information about our certificates:

https://ed.lehigh.edu/academics/degrees/certificates (https://ed.lehigh.edu/academics/degrees/certificates/)

For more information about our doctoral degree:

https://ed.lehigh.edu/academics/degrees/doctoral-degrees (https://ed.lehigh.edu/academics/degrees/doctoral-degrees/)

4+1 Bachelor's Plus Accelerated Master of Education in Elementary Education and PreK-4 Certification

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:

B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master's program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

Core Course Work (21 credit hours)		
SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 380	Child Development and Cognition	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3
TLT 411	Early Childhood Education	3
Development of Professional Skills (18 credit hours)		
TLT 412	Social Studies in PreK through 4th Grade	3
TLT 420	Literacy in PreK through 4th Grade: Reading and Its Foundations	3
TLT 422	Literacy in PreK through 4th Grade: Writing and Its Foundations	3
TLT 426	Science in PreK through 4th Grade	3
TLT 428	Mathematics and Numeracy in PreK through 4th Grade	3
SPED 465	Advanced Inclusionary Practices in K-12	3
Extended Field Experience (3-6 credit hours)		
TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (3 credit hours)

Senior Year (12 credit hours)

College of Education - Summer (12 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in the 5-year program will take 18 credits pre-bachelor's and an additional 27 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

4+1 Bachelor's Plus Accelerated Master of Education in Secondary Education and Teacher Certification

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

PROGRAM OF STUDY:

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor's degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:

Core Coursework (15 credits)		
SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3
Development of Professional Skills (12 credits)		
Content-area teaching methods course with approval of adviser (one of the following):		
TLT 431	Social Studies in Middle Level and High School Education	3
TLT 434	English in Middle Level and High School Education	3
TLT 436	Science in Middle Level and High School Education	3
TLT 438	Mathematics in Middle Level and High School Education	3
Plus:		
TLT 432	Reading and Critical Thinking in Middle Level and High School Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
TLT XXX Elective with adviser approval		3
Extended Field Experiences (6-9 credits)		
TLT 440	Pre-professional Seminar	3
TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (6 credit hours)

Senior Year (6 credit hours)

College of Education - Summer (6 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

MASTER OF EDUCATION IN ELEMENTARY EDUCATION AND PREK-4 TEACHER CERTIFICATION

This 42-credit (minimum) program prepares students for Pennsylvania Level I certification as PreK-4 teachers and leads to the awarding of a master's degree in Elementary Education. Students complete coursework in three categories:

Core Course Work (21 credit hours)		
SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 380	Child Development and Cognition	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3
TLT 411	Early Childhood Education	3
Development of Professional Skills (18 credit hours)		
TLT 412	Social Studies in PreK through 4th Grade	3
TLT 420	Literacy in PreK through 4th Grade: Reading and Its Foundations	3
TLT 422	Literacy in PreK through 4th Grade: Writing and Its Foundations	3
TLT 426	Science in PreK through 4th Grade	3
TLT 428	Mathematics and Numeracy in PreK through 4th Grade	3
SPED 465	Advanced Inclusionary Practices in K-12	3

Extended Field Experience (3 credit hours)

TLT 444	General Education Student Teaching and Seminar	1-6

Thirty (30) credits minimum is required for the master's degree. In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification (English, mathematics, science, social studies). At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas (language arts, mathematics, science and social studies). The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

MASTER OF EDUCATION IN SECONDARY EDUCATION AND TEACHER CERTIFICATION

This 33 credit (minimum) program of study prepares students for Pennsylvania Level I certification as secondary content-area teachers in one of the subject areas (below) and leads to eligibility for a master's degree in secondary education:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

Students complete coursework in three categories:

Core Coursework (15 credit hours)

SPED 332	Introduction to Inclusion and Exceptional Education	3
TLT 404	Cultural and Linguistic Diversity	3
TLT 405	Principles and Applications of K-12 Assessment	3
TLT 407	Instructional Design for K-12 Classrooms	3
TLT 409	K-12 Classroom Environment and Management	3

Development of Professional Skills (12 credit hours)

Content-area teaching methods course with approval of your adviser (one of the following):		
TLT 431	Social Studies in Middle Level and High School Education	3
TLT 434	English in Middle Level and High School Education	3
TLT 436	Science in Middle Level and High School Education	3
TLT 438	Mathematics in Middle Level and High School Education	3
Plus:		
TLT 432	Reading and Critical Thinking in Middle Level and High School Education	3
SPED 465	Advanced Inclusionary Practices in K-12	3
TLT XXX Elective with adviser approval		3

Extended Field Experiences (6 credit hours)

TLT 440	Pre-professional Seminar	3
TLT 444	General Education Student Teaching and Seminar	1-6

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter are of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Master of Education in Teaching and Learning

The goal of the master's in Teaching and Learning is to enhance practicing educators' evidence-based pedagogical knowledge and skills to optimize their design of classroom learning environments, including developing and implementing innovative curricula and learning activities. Different specialization tracks are available based on students' areas of interests, with some specializations linking to additional Pennsylvania Department of Education certifications/ endorsements.

Core Coursework (15 credits)

EDUC 403	Research	3
EDUC 471	Diversity and Multicultural Perspectives	3
TLT 401	Overview of Teaching and Learning	3
TLT 403	Introduction to Instructional Design	3
TLT 480	Curriculum Theory and Design	3

Electives (15 credits; select courses from the tracks below)

Track 1: Technology and Design		
TLT 368	Teaching and Learning with Geospatial Tools	3
TLT 369	Applied Geospatial Tools	3
TLT 458	Introduction to Multimedia Programming and Development	3
TLT 460	Advanced Multimedia Programming and Development	3
TLT 462	Special Topics in Development of Instructional Resources and Technologies for Learning	1-3
TLT 476	Assessment of Instructional Technologies	3
Or other electives as approved by advisor		
Track 2: Innovative Pedagogy		
TLT 367	Environmental Education	3
TLT 464	Digital Storytelling	3
TLT 465	Design Thinking for Learning	3
TLT 467	Project-, Scenario-, & Simulation-Based Learning in Interactive Multimedia Environments	3
TLT 468	Game-Based Learning	3
Or other electives as approved by advisor		
EDUC 391	Educational Linguistics	3
Track 3: English as a Second Language (if complete all coursework, eligible students may apply for a PDE certification)		
TLT 404	Cultural and Linguistic Diversity	3
EDUC 419	Second Language Acquisition	3
EDUC 420	Contemporary Issues in Multilingual Learner Education	3

EDUC 423	Curriculum and Materials Design for Multilingual Learners	3
Track 4: Social-Emotional Behavioral Wellness (if complete all coursework, eligible students may apply for a PDE endorsement)		
EDUC 406	Social Emotional Learning in Context	3
EDUC 431	Multi-Tiered Systems of Social-Emotional Support	3
EDUC 434	Prevention and Management of Crisis	1
EDUC 435	Implementation for Equity: Leading Student-Centered Schools	1
EDUC 436	Implementation for Equity: Social Emotional Learning in Action	1
EDUC 456	Trauma and Resilience in Schools	3

Master of Science in Instructional Technology

A thirty-credit masters degree offered through the Teaching, Learning, and Technology program. The program is aimed at those interested in the use of technology in education, particularly preK-12 and post secondary settings.

The 30-credit Master of Science in Instructional Technology program focuses on the planning and use of instructional technology in preK-12 and post secondary settings and non-formal learning environments (such as museums and science centers). The program is targeted toward individuals from varied backgrounds who wish to help educators or learn themselves to design, develop, and incorporate technology applications more effectively in diverse educational settings including preK-12, post secondary education, and informal learning environments. This is an appropriate degree for those who teach in the classroom and online, technology specialists, informal educators, and others interested in effectively using information and communications technologies to enhance instruction.

The program is designed to help develop skills that can be used to create new curriculum and learning activities to meet the demands of a changing technological society and the needs of new generations of students. As such, graduates may be designing online courses, enhance existing curriculum with emerging technologies, or may work as technology specialists, assisting with the integration of technology in academic and informal learning environments. The Instructional Technology graduate program is intended for both current professionals in the education field as well as those who are seeking an advanced degree to upgrade their skills and knowledge base related to technology.

College Core Requirements (3 credits)

EDUC 471	Diversity and Multicultural Perspectives	3

Program Core Requirements (15 credits)

TLT 401	Overview of Teaching and Learning	3
TLT 403	Introduction to Instructional Design	3
TLT 458	Introduction to Multimedia Programming and Development	3
TLT 460	Advanced Multimedia Programming and Development	3
TLT 476	Assessment of Instructional Technologies	3

Electives (pick 4 for 12 credits)

TLT 367	Environmental Education	3
TLT 368	Teaching and Learning with Geospatial Tools	3
TLT 462	Special Topics in Development of Instructional Resources and Technologies for Learning	1-3
TLT 470	Technology for Teaching and Learning	3
TLT 474	Large-scale Planning and Implementation of Educational Technology	3
TLT 480	Curriculum Theory and Design	3
EDUC 493	Internship in: (with subtitle)	1-6
Other electives as approved by advisor		0-6

Master of Science in Teaching, Learning, and Technology

The master of science in Teaching, Learning, and Technology is a 30-credit master's program. The TLT M.S. is available ONLY to students previously admitted to the TLT Ph.D. program and specifically those students who are NOT completing their doctorate. This MS is provided solely for those students who have completed the core coursework (i.e., 30 or more credits completed, including 12 credits in Foundations, 3 credits in Research, and 15 credits from other courses listed and/or through directed research) but are unable to progress through the culminating research projects of a doctoral degree. There is no thesis requirement for this master of science; it is a coursework-only masters. Awarding of such degree shall be dependent upon the student meeting all relevant university and College of Education requirements for master's degrees.

Doctor of Philosophy in Teaching, Learning, and Technology

A 48-credit, post-master’s doctoral degree offered through the Teaching, Learning, and Technology program.

The doctorate in Teaching, Learning, and Technology (TLT) is a 48-credit, post master's Ph.D. program. The TLT Ph.D. program employs a scientist/practitioner model of learning. That is, research is not separate from application or practice. Our doctoral students collaborate closely with faculty to generate new theories and classification systems, innovative curricula, technology-integrated learning environments, authentic approaches to assessing learning, and a wide range of creative methods of teaching and learning in a global world highly interconnected by technology.

In keeping with the scientist/practitioner model, our doctoral students learn through innovative approaches, including research-based strategies for curriculum delivery, synchronous and asynchronous environments, and a wide range of other technology-enhanced designs and approaches for learning. Students take about 42 credits of coursework in addition to their qualifying examination preparation, doctoral research project, and dissertation project. Coursework is individualized according to the concentration students decide to pursue. Also, many of the course assignments are project-based, which will allows students to apply concepts they are learning to their particular area of interest. In addition, the choice of research topic and projects is also up to the student --in consultation with his/her faculty adviser and within the broader context of the field, of course.

Foundations (12 credits)

Required:		
EDUC 471	Diversity and Multicultural Perspectives	3
TLT 401	Overview of Teaching and Learning	3
TLT 402	Reading and Writing for Research Publication	3
TLT 403	Introduction to Instructional Design	3

Research (12 credits)

Required:		
EDUC 403	Research	3
EDUC 408	Introduction to Statistics	3
EDUC 409	Analysis of Experimental Data	3
Electives (select at least one):		
EDUC 405	Qualitative Research Methods	3
EDUC 410	Univariate Statistical Models	3
EDUC 411	Multivariate Statistical Models	3
EDUC 412	Advanced Applications of Psychometric Principles	3
EDUC 461	Single-Subject Research Design	3
Other statistical research course in TLT, COE, or A&S as approved by adviser.		

Additional courses as required by adviser.

Professional Cognate (12 credits)

Required:		
TLT 480	Curriculum Theory and Design	3
Electives:		
EDUC 491	Advanced Seminars: (with subtitle)	1-6
EDUC 493	Internship in: (with subtitle)	1-6
EDUC 496	Doctoral Research Seminar	3
TLT 458	Introduction to Multimedia Programming and Development	3
TLT 460	Advanced Multimedia Programming and Development	3
TLT 462	Special Topics in Development of Instructional Resources and Technologies for Learning	1-3
TLT 470	Technology for Teaching and Learning	3
TLT 474	Large-scale Planning and Implementation of Educational Technology	3

Other learning and instruction elective course in TLT, COE, or CAS as approved by adviser.

Supervised Research Projects (6 credits minimum)

Required:		
TLT 486	Doctoral Research Project I: Design & Development	3
TLT 499	Dissertation	1-15
Electives:		
EDUC 493	Internship in: (with subtitle)	1-6
EDUC 494	Field Work in: (with subtitle)	3
EDUC 495	Independent Study in: (with subtitle)	1-6

Additional topic seminars, dissertation proposal or maintenance of candidacy, or elective with permission of adviser.

Professional Sub-Specialty (6 credits)

These credits are intended to advance the students' research agenda or career goals (such as a enhanced subject matter knowledge, mentored field/practical experiences with outreach programs, specialized coursework, college teaching, grant writing, and the like) with adviser approval.

Learning Design for Educational and Professional Settings certificate

Lehigh's 12-credit Certificate program is aimed at post-certification in-service teachers, informal educators, and other professionals seeking to expand their skills and knowledge of learning design and instructional technology. Professionals enrolled in the program will learn best practices in how to design and develop personalized instruction as well as implement and integrate new and emerging instructional technologies to enhance learning outcomes for youth and adults in a variety of educational settings, including informal learning environments.

Game-Based Learning certificate

This four-course certificate is aimed for educators who are seeking ways to infuse innovative game-based pedagogy into their formal or informal educational settings. Students will gain a rich understanding of cognition and instructional design that provide the foundation of these engaging teaching strategies.

Artificial Intelligence and Learning Analytics for Education Certificate

This 12-credit graduate certificate program will allow educators, researchers, and developers to expand their skills with artificial intelligence (AI) and learning analytics for use in a variety of educational settings. Students will have the opportunity to explore learning theories and data visualization techniques, access and manage AI systems, and apply their understandings and skills in selected field settings.

TLT 450	Introduction to Learning Analytics	3
TLT 451	Data Visualization	3
TLT 461	Introduction to Artificial Intelligence in Education	3
TLT 469	Applied Artificial Intelligence and Machine Learning for Education	3

Courses

TLT 367 (EVST 367) Environmental Education 3 Credits
Introductory environmental education course designed to prepare students to implement environmental education opportunities in formal and non-formal education settings. Topics include history and philosophy of environmental education, environmental laws and regulations, GIS, environmental issues and decision making, curriculum integration and environmental education teaching methodologies. This is a Web enhanced containing both online and fieldwork components.

TLT 368 (EVST 368) Teaching and Learning with Geospatial Tools 3 Credits
Exploration of geospatial tools, including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth). Application of these tools and techniques to instructional settings, including appropriate pedagogy and assessment. Not available for credit for students who have completed EVST/TLT 369.

TLT 369 (EVST 369) Applied Geospatial Tools 3 Credits
Introduction to geospatial tools--including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth)--and related concepts such as geo-databases, map projection, and remote sensing. Application of these tools and techniques to research, policy, business, public health, and communications. Not available to students who have taken EVST/TLT 368.

TLT 371 The Business, Social, and Education Entrepreneur 3 Credits
Release your inner entrepreneur! This course offers an introduction to entrepreneurial thinking and action as applied to an innovative startup business, school initiative, or non-profit institution. The course is fully online, with asynchronous and synchronous sessions. Students will learn from case study exemplars across many fields that demonstrate the roles of creativity, planning, funding, and perseverance. Participants will learn by preparing a startup plan, writing sections throughout the course as the topics are studied.

TLT 380 Child Development and Cognition 3 Credits
Introduction to physical, motor, perceptual, cognitive, language, emotional, social, and gender development of young children and adolescents. Developmental history, theories, and research, as well as the effect of culture, family, peers, media, and schooling on the individual and groups. Students investigate typical and atypical development and explore the implications of individual differences for teaching and learning, with an emphasis on evidence-based instructional practices designed to optimize the growth and development of all learners. Explores mental health issues and at-risk students.

TLT 391 Workshops 1-3 Credits
Cooperative study of current educational problems. Provides elementary, secondary, and special education teachers an opportunity to work at their own teaching levels and in their own fields. Limited to six credits during a summer session but the student may register for more than one workshop provided there is no duplication in subject matter.
Repeat Status: Course may be repeated.

TLT 394 Special Topics in Education: 1-3 Credits
Examination of a topic of research or professional interest in education. Subtitle will vary. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

TLT 401 Overview of Teaching and Learning 3 Credits
Foundations and key concepts in learning and instructional theory. Cognition and brain-based research with a focus on innovations in teaching and learning.

TLT 402 Reading and Writing for Research Publication 3 Credits
Using literature to build persuasive written arguments. Searching and identifying promising sources, distilling research findings, synthesizing literature to support an argument, and organizing written materials to enhance persuasiveness. Suited to those writing qualifying projects, dissertation proposals, dissertations, funding proposals, conference proposals, and journal articles.

TLT 403 Introduction to Instructional Design 3 Credits
Social, cognitive, and environmental factors in designing for teaching and learning. Systems theory applied to learning settings. Special emphasis on motivational theories and technological affordances.

TLT 404 (SPED 404) Cultural and Linguistic Diversity 3 Credits
All teachers need to gain an understanding of how to support culturally and linguistically diverse students, particularly multilingual learners (MLs). This course explores the systemic disadvantage and bias MLs experience in the school system. It will offer best practices and concrete strategies that teachers can implement to challenge systemic disadvantages MLs face in classrooms and schools. With the understanding that students have complex identities and needs, throughout the course, the heterogeneity of culturally and linguistically diverse students will be emphasized.

TLT 405 (SPED 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

TLT 407 Instructional Design for K-12 Classrooms 3 Credits
Introduces the systematic design of instruction following the Response to Instruction and Intervention (RtII) and Universal Design for Learning models. Explores theories of learning and instructional applications as a part of technology-based and standards-aligned classroom education grounded in the use of a quality, research-based core curriculum and effective instructional practices to meet the needs of all learners. Addresses appropriate use of instructional technologies for universal learning. Students will plan, design, and develop student-centered, standards-aligned, technology-supported instruction and appropriate learner assessments.

TLT 409 (SPED 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a positive learning environment using evidence-based classroom management strategies for all learners, including students with disabilities and those from culturally and linguistically diverse backgrounds. Addresses function-based thinking to understand behavior problems and identify appropriate interventions. Includes discussion of manifestation of both internalizing and externalizing problems and related interventions.

TLT 410 The Writing Process 3 Credits
Developmental characteristics of children's writing and relationships among writing, spelling and reading. Predictors of writing achievement, teaching strategies and activities, and evaluation schemes will be emphasized, K-12.

TLT 411 (SPED 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

TLT 412 Social Studies in PreK through 4th Grade 3 Credits
Overview of Pennsylvania's PreK-4 Standards for social studies, including: Pennsylvania history, United States history, economics, civics and government, citizenship, political science/government, and geography. Development, implementation and evidence-based assessment of preK-grade 4 social studies curricula. Effective teaching techniques such as lesson planning, inclusive practices, integrating instructional technologies into instruction, reflecting on teaching, and the latest research-based teaching and assessment methods. Emphasis on alignment of instruction with standards.

TLT 420 Literacy in PreK through 4th Grade: Reading and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach reading and early reading skills in PreK-4th grade. Understanding of the skills of successful readers. Evidence-based practices in reading instruction and data-based decision-making to teach reading to all students, including students with disabilities and English learners. Strategies to partner with caregivers to enhance reading an early reading skills.

TLT 422 Literacy in PreK through 4th Grade: Writing and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach writing and foundational skills in PreK-4. Understanding of the developmental aspects of writing and the skills of successful writers. Evidence-based practices in writing instruction and data-based decision-making to teach writing to all students, including students with disabilities and English learners.

TLT 424 Children's Literature in Elementary Education 3 Credits
Role of literature in the instructional program of the elementary schools. Use of trade books for individualized instruction in reading, language arts, mathematics, science, and social studies.

TLT 426 Science in PreK through 4th Grade 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in preK-grade 4 classrooms. Emphasis on Pennsylvania's PreK-4 Standards for Science and Technology and Environment and Ecology standards and aligning instruction with standards. activities include planning effective lessons, trying out new methods of teaching, reflective practice, inclusionary methods, and integrating instructional technologies into science learning. Evidence-based assessment types are highlighted within instructional contexts.

TLT 428 Mathematics and Numeracy in PreK through 4th Grade 3 Credits
Trends, theories, activities and manipulative materials for teaching early numeracy and elementary mathematics. Pre-school development and in-school skills and concepts, including sets, systems of numeration, experience with numbers, number operations and concepts, numerals, measurement, early algebra, and elements of geometry. Implications of developmental differences and early non-school experiences on learner readiness and skills. Helping parents support their children's mathematics conceptual development. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across ability levels.

TLT 431 Social Studies in Middle Level and High School Education 3 Credits
Middle and high school curriculum, content, teaching strategies, and instructional materials for the social studies. Emphasis on organizing content, using appropriate methods, testing and evaluation, and appropriate integration of technology. Overview of Pennsylvania's 4-8 and 8-12 standards for social studies and related standards from the National Council for the Social Studies and other national organizations. Explores relevant research, courses of study, textbooks, and teacher-made materials. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 432 Reading and Critical Thinking in Middle Level and High School Education 3 Credits
Development of reading in the secondary content areas (English/language arts, mathematics, science, social studies). Highlights effective teaching strategies in critical areas, such as higher order reading and study skills. Addresses analysis of evidence based methods and current research for improving the reading development and analytical skills of all students.

TLT 434 English in Middle Level and High School Education 3 Credits
Curricula, philosophy, methods, strategies, and materials for the teaching of middle and high school English. Literature, genres, and the nature of text and text differences. Critical analysis and drawing inferences from narrative text and poetry. Techniques for teaching and enhancing writing in various styles. Applications of technology and assessment principles. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 436 Science in Middle Level and High School Education 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in secondary science classrooms. Emphasis on aligning instruction with Pennsylvania's Standards for Science and Technology and Environment and Ecology standards. activities include planning effective lessons, trying out new methods of teaching, inclusionary methods, reflective practice, and integrating instructional technologies into science learning. Evidence-based assessment types highlighted within instructional contexts.

TLT 438 Mathematics in Middle Level and High School Education 3 Credits
Standards-based and technology-intensive curricula, instructional activities, and manipulative aids for mathematics in middle level and high schools. This course models and explores an investigative and hands-on approach to secondary mathematics instruction. Particular attention given to learning theories, curriculum issues, and recommendations arising from state, national, and international assessments. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across a range of abilities. Addresses standards-aligned instructional approaches and techniques, including co-teaching.

TLT 440 Pre-professional Seminar 3 Credits
Study, directed observation of, and initial practice in the various phases of teaching in secondary schools. Guided opportunities to try out strategies to facilitate the inclusion of special education students, differentiated instructional practices, and standards-aligned and evidence-based instructional approaches in actual school settings. Consent of program coordinator required.

TLT 442 (SPED 442) General Education and Special Education Student Teaching and Seminar 4-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 444 General Education Student Teaching and Seminar 3-6 Credits
Intensive practice in the application of principles of teaching for general education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 450 Introduction to Learning Analytics 3 Credits
Data-informed decision-making is essential for improving teaching and learning practices. This course is designed for anyone interested in using data to improve education and learning outcomes. This course will provide you with the skills and knowledge necessary to succeed in the growing field of learning analytics. This course covers the basics of learning analytics (LA), including LA concepts, models, frameworks, and techniques. We will also discuss key ethical considerations in LA, including privacy, security, and bias.

TLT 451 Data Visualization 3 Credits
Educators are currently expected to comprehend, process, and handle large quantities of datasets with a variety of data types. In this course, learners will be provided with opportunities to learn the concepts and skills of data visualization, manage real-life data visualization tasks, interpret visualization outcomes, and enhance their understanding of data-driven decision-making.

TLT 454 Applied Instructional and Learning Design Principles 3 Credits
Exploration and application of design models for learning. Special emphasis on the application of teaching and learning theories and instructional design strategies and models to design and develop authentic learning products or experiences, iterate projects, and reflect on personal preferences and processes as designers.
Prerequisites: TLT 403

TLT 456 Instructional Design and Development Studio 3 Credits
Studio-based, authentic and collaborative design experiences led by a faculty mentor. Students work in teams to complete substantial multimedia design and development projects.
Prerequisites: TLT 454 and TLT 460

TLT 458 Introduction to Multimedia Programming and Development 3 Credits
Introduction to programming and resource development tools used in the creation of interactive multimedia teaching and learning materials.

TLT 460 Advanced Multimedia Programming and Development 3 Credits
Advanced exploration of programming and resource development tools used in the creation of interactive teaching and learning materials.
Prerequisites: TLT 458

TLT 461 Artificial Intelligence and Machine Learning for Education 3 Credits
Most educated people are mystified by artificial intelligence and machine learning. This course demystifies these emerging technologies through simple theory and hands-on experience. We will build AI and machine learning systems and apply them to tasks in teaching, learning, and administration. We will compare our understanding of machine learning with human learning, and we will extrapolate the state of technology today to the changes we can expect to see in the near future in education, economics (jobs), and daily life.

TLT 462 Special Topics in Teaching, Learning, and Technology 1-3 Credits
We know the field of teaching, learning, and technology is evolving at a rapid pace. This course focuses on innovations in teaching, learning, and technology.
Repeat Status: Course may be repeated.

TLT 463 Building Makerspaces for Learning 3 Credits
A Makerspace is both a space and a mindset. By encouraging play, design, tinkering, and creative inquiry, these spaces and mindsets can create transferable, high-order thinking skills, knowledge, and attitudes/beliefs about many topics. This course will discuss the fundamentals of why, what, where, and how to build and incorporate different types and "levels" of Makerspaces into any instructional setting.

TLT 464 Digital Storytelling 3 Credits
The art and practice of storytelling is assuredly almost as old as the advent of formal language itself, and for nearly all of that time, with few exceptions individual storytellers have been bounded within an analog framework. Recently, various digital tools have emerged (or have become more accessible) that facilitate digital storytelling, implications of which are potentially wide-ranging for technologists, educators, and students alike. This course will critically examine the comparatively nascent world of digital storytelling. We will first consider.

TLT 465 Design Thinking for Learning 3 Credits
In this project- and theory-based course, students will apply elements of design thinking to the development and production of curricular and instructional materials that support audience learning, engagement, and performance. Students will demonstrate knowledge, skills, and appropriate attitudes/beliefs [KSABs] in the design and development of a course-long project, group design challenge, and several project-based activities throughout the semester.

TLT 466 Field Experience: General Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching in general education in a supervised experience in the schools for students who already hold special education certification. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of the program director.

TLT 467 Project-, Scenario-, & Simulation-Based Learning in Interactive Multimedia Environments 3 Credits
This course focuses on the design, development, and implementation of authentic project-, scenario-, and simulation-based learning environments using interactive media. Students will apply various instructional design models, learning theories, and multimedia tools to create project-, scenario-, and simulation-based materials, visuals, and other digital media and assess the results. Students will explore story, character, and challenge design, choice creation, and consequence feedback loops to develop classroom or corporate, online, and mobile interactive learning environments.

TLT 468 Game-Based Learning 3 Credits
Learning games are designed through a combination of instructional and motivational design principles. Through playful, hands-on experiences, this course will address the theory, practice, and development of learning games in education. Participants will produce and test student-developed learning games.

TLT 469 Applied Artificial Intelligence and Machine Learning for Education 3 Credits
This course provides a comprehensive introduction to machine learning and its applications in the field of education. Through hands-on activities and practical explorations, students will gain the knowledge and skills to explore how machine learning can be used to improve teaching, learning, and assessment.

TLT 470 Technology for Teaching and Learning 3 Credits
Analysis of available technologies (hardware, software, and Web resources), and identification of technologies matched to learner needs in traditional and/or non-traditional settings.

TLT 472 Online Teaching and Learning 3 Credits
Examination of contemporary research on online learning and recognized best practices on the design and delivery of online, hybrid, and/or flipped courses or course modules. Emphasis on online activities to experience ways to maximize instructor presence and student engagement, collaboration, and achievement.

TLT 474 Large-scale Planning and Implementation of Educational Technology 3 Credits
Addresses topics such as planning, maintaining, funding, networking, staffing, staff development, and monitoring of educational technology implementations.

TLT 475 Trends and Innovations in Instructional Technology 3 Credits
Examination of current research and emerging trends in instructional technology with the goal of anticipating the development and diffusion of new practices in schools and school systems. As William Gibson famously said, “The future is here today, it’s just not evenly distributed.”

TLT 476 Assessment of Instructional Technologies 3 Credits
Techniques for evaluating technology implementations for teaching and learning. Focus on topics such as instrumentation, data collection and analysis, drawing conclusions from data sets, and preparing reports for stakeholders.

TLT 477 Cognitive Theory and Technology Integration 3 Credits
The spread of instructional technology systems and expanding knowledge of how we think and how learn has changed the ground beneath educators' feet. This course provides teachers with practical examples and frameworks for applying cognitive science and technology to benefit students through increased engagement, increased formative evaluation, and more.

TLT 478 School Leadership in the Digital Age 3 Credits
Successful implementation of any initiative in schools is contingent on support from leadership, whether it be administrators or teacher leaders. This course will focus on the characteristics of good leadership and how they may be applied in successful technology integration strategies. Concepts will be explored around creating an environment of equity through digital access, being a champion for personalized learning, and building a collaborative ecosystem of support.

TLT 479 Technology Integration Coaching 3 Credits
Instructional technology coaches work collaboratively with peer teachers to improve teaching, with a focus on the appropriate and effective uses of educational technologies. Practices include identifying a baseline of practices and habits of mind, setting meaningful goals for integration based on resources and student needs, assisting teachers in developing technology literacy, aiding teachers in integration, and providing ongoing support for success. This course will investigate the basic tenets of instructional coaching and then delve into evidence-based strategies for content-area instruction.

TLT 480 Curriculum Theory and Design 3 Credits
Curricular models and their features, with a focus on curriculum development and enactment. Special emphasis on design principles, curriculum’s role in K-12 settings, and technology-enhanced curriculum.

TLT 482 Practicum in University Teaching: Teaching, Learning & Technology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Teaching, Learning and Technology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

TLT 483 Diversity and Multicultural Perspectives in International Education 3 Credits
Examination of the influence of culture, gender, and disabilities on behavior and attitudes. Historical and current perspectives on race,culture, gender, sexual orientation, gender identity diversity, and minority group issues in education and psychology. The primary context of application is contemporary international education.

TLT 486 Doctoral Research Project I: Design & Development 3 Credits
This course provides students with the opportunity to design and develop research studies under the supervision of specific faculty.
Repeat Status: Course may be repeated.

TLT 487 Doctoral Research Project II: Implementation, Analysis, & Writing 3 Credits
This course provides students with the opportunity to implement, analyze, and write-up research studies under the supervision of specific faculty.
Repeat Status: Course may be repeated.

TLT 492 Classroom Research Methods 3 Credits
Introduces students to classroom research design paradigms and the assumptions behind them, use of the literature, developing research questions, qualitative and quantitative procedures, research design, sampling design, data collection, data analysis, and reporting research results using educational applications.

TLT 494 Culminating Research Project 3 Credits
Designing and conducting research projects in classroom settings.

TLT 499 Dissertation 1-15 Credits

College of Health

College Leadership:

Elizabeth A. Dolan, *Dean*
Erica Hoelscher, *Associate Dean for Faculty and Staff*
Won Choi, *Associate Dean for Research and Graduate Education*
Michael Gusmano, *Associate Dean for Academic Affairs*

Contact information:

Health | Science | Technology Building
College of Health Administrative Suite #155
124 East Morton Street
610.758.1800 | (incoh@lehigh.edu) incoh@lehigh.edu
website: health.lehigh.edu (https://health.lehigh.edu/)
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Lehigh's College of Health strives for a world where everyone can reach their highest level of health. We make unconventional connections across diverse fields of study, conduct research that prioritizes real-world impact, and provide education through experience.

Through the Department of Community & Population Health, we offer degree programs at undergraduate and graduate levels. Our faculty conduct research, often with students, and address health comprehensively, accounting for the unique factors that impact, or determine, health, including race, gender, food security, policy, and physical environment. Faculty and students partner with affected communities to create technology-forward, data-driven methods of improving health equity that are culturally appropriate, accessible, and truly useful to the communities they are made to empower.

We prepare students to advance health equity with experience that will make you stand out, whether you pursue higher education like medical school, or a career in healthcare, consulting, government, nonprofit, or any of the other many areas in the health economy.

UNDERGRADUATE

College of Health programs prepare students for a myriad of careers in health and healthcare. Students receive an applied education through a multi-disciplinary approach, emphasizing community partnership and the use of technology and data. We offer BA and BS degrees as well as minor programs that integrate ethics, cultural understanding, and social justice. Regardless of the degree program, real-world experience is central to a College of Health degree— 25% of our major course requirements are experiential. All students have the opportunity to engage in health-related research projects, field experiences, internships, study abroad programs, and more. With our hands-on, comprehensive approach to health, students learn how health and illness are just pieces of the larger puzzle of social, political, and environmental determinants, and strive to create a world where health equity is accessible for everyone.

Upon completing any bachelor's degree in the College of Health, students will…

1. Demonstrate mastery of the determinants of health from a holistic and interdisciplinary perspective.
2. Demonstrate proficiency in health literacy.
3. Analyze the ethical complexities of health research and health decision-making.
4. Demonstrate proficiency in writing and critical reading skills.
5. Demonstrate proficiency in the methods appropriate for their field of study.
6. Apply course concepts to the real-world context to improve the health of communities and populations.
7. Critically evaluate theoretical frameworks for understanding health issues through an interdisciplinary and equity-focused lens.
8. Demonstrate an understanding of the importance of sustainability as it relates to health.

To meet the above learning objectives, all students in the College of Health must fulfill the following college's distribution requirements. Students will complete 10 classes of distribution requirements totaling 32-37 credits. Many of these classes will be available through the individual majors in the college. Students can double count a writing-intensive distribution requirement with *one additional* distribution requirement; however, they cannot double count across other distribution categories (i.e., determinants, bioethics, etc.). Allowances for double counting distribution courses with major electives is determined by the selected major.

For additional information about any of our undergraduate programs, visit our website (https://health.lehigh.edu/) or email us at cohadvising@lehigh.edu.

First Year Seminar	(1 class, 3-4 credits)	Varies by semester
Scientific Writing	(4 classes, 12-14 credits)	WRT 001 or 003 Academic and Analytical Writing, WRT 002 or 005 Research and Argument, (2) upper-level classes designated as health science writing listed below
Determinants of Health	(2 classes, 8 credits)	CGH 103 Biological & Environmental Determinants of Health, CGH 104 Sociocultural & Political Determinants of Health, CGH 105 Commercial Determinants of Health
Bioethics	(1 class, 3-4 credits)	POPH 003 Justice, Equity, and Ethics in Population Health or POPH 319 Population Health Bioethics
Diversity, Equity, and Inclusion	(1 class, 3-4 credits)	chosen from a list of approved classes listed below
Sustainability	(1 class, 3-4 credits)	chosen from a list of approved classes listed below

Health Science Writing Courses

CGH 313	Health Policy and Politics	3
CGH 314	Advanced Commercial Determinants of Health	3
CGH 315	Medical Mysteries	3
CGH 316	Global Environmental Disasters & Policy	3
CGH 317	Sex, Drugs, and Trauma	3
CGH 319	Public Health Law	3
CGH 322	Contemporary Indigenous Health	3
CGH 332	Aging, Health, and Social Policy	3

Diveristy, Equity & Inclusion Courses		
CGH 002	Introduction to LGBTQ2+ Health	3
CGH 021	Culture and Health	3
CGH 022	Global Perspectives on Health	3
CGH 122	Indigenous Healing Traditions	3
CGH 311	Religion, Spirituality, and Health	3
CGH 312	Curses, Possessions, and Supernatural Illnesses	3
CGH 318	Sexuality Education	3
CGH 322	Contemporary Indigenous Health	3
Sustainability Courses		
CGH 102	Community Health and Engineering	3
CGH 108	Food Justice	3
POPH 106	Global Environment and Human Welfare	3
CGH 316	Global Environmental Disasters & Policy	3

MAJOR AND MINORS

MAJORS	MINORS
BS Biostatistics & Health Data Science	Biostatistics
BS Population Health	Community Health
BA Community & Global Health	Epidemiology
BA Health, Medicine, and Society	Global Health
	Population Health
	Indigenous Peoples' Health
	Health Policy & Politics
	Maternal & Child Health

GRADUATE PROGRAMS

College of Health graduate programs equip students to understand and appropriately improve the health and well-being of populations and communities locally, nationally, and globally. Students investigate and address the multiple determinants of health through technology- and data-driven research and community partnership in all College of Health graduate programs. We empower our graduate students to shape the future into one where health equity is accessible for all.

For more information, contact cohgrad@lehigh.edu (inchgrad@lehigh.edu).

PhD Population Health	Master of Science in Population Health Management (MS)
Master of Public Health (MPH)	4+1 Accelerated Master of Public Health (MPH)
MBA/MPH (with the College of Business)	4+1 Accelerated Master of Science in Population Health Management(MS)
Graduate Certificate in Population Health	Graduate Certificate Global Health
4+1 Master of Engineering in Healthcare Systems Engineering (with the P.C. Rossin College of Engineering and Applied Science)	Flex MBA with Healthcare Management Concentration (with the College of Business)

A PATH TO MEDICAL, DENTAL, OR VETERINARY SCHOOL

Pre-health students are those students interested in pursuing graduate-level study in a health field such as allopathic (M.D.) or osteopathic (D.O.) medicine, dentistry, or veterinary medicine. Pre-health students at Lehigh have the flexibility to major in the field of their preference, since Lehigh does not offer defined “pre-med” or “pre-dental” tracks. Our programs allow students to follow their strengths and passions while also completing the prerequisite coursework needed for their intended medical, dental, or other professional programs, in addition to the suggested coursework for the MCAT exam.

CAREERS

Career pathways for students studying in the College of Health are abundant and wide-ranging. Students pursue employment directly in the steadily-growing healthcare sector at health systems and hospitals, in the private sector at consulting firms and pharmaceutical companies, in political and governmental fields at state, federal and international levels, as well as the nonprofit sector at NGOs and community-based organizations. We prepare students to advance health equity through a variety of avenues including epidemiology, medicine, data science, biostatistics, public health, community health, global health, health economics, health policy, health promotion, health research, and health technology and innovation. At the College of Health, students prepare for a flourishing career and a pathway dedicated to helping others.

RESEARCH CENTERS AND INSTITUTES

Lehigh’s College of Health is home to three interdisciplinary institutes that focus on investigative research on specific topics and areas of expertise. Lehigh and its partners invest in research institutes that excel at focused and multidisciplinary studies, working together to solve problems both locally and globally. We study, analyze, and develop knowledge in areas of health using collaboration and communication to help generate discoveries.

- Institute for Indigenous Studies (IIS) **(**https://health.lehigh.edu/research-partnerships/institute-indigenous-studies/**)**
- Institute for Health Policy and Politics (IHPP) **(**https://health.lehigh.edu/research-partnerships/institute-health-policy-politics/**)**
- Children's Environmental Precision Health Institute (CEPH) **(**https://health.lehigh.edu/research-partnerships/childrens-environmental-precision-health-institute/**)**

Community and Population Health

DEPARTMENT CHAIR:

Christine Daley, *Professor*

DEPARTMENT FACULTY:

A listing of College of Health faculty may be found at health.lehigh.edu/faculty (https://health.lehigh.edu/faculty/)

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social: @lehighcoh

UNDERGRADUATE MAJORS

Biostatistics & HEalth Data Science

The Bachelor of Science (BS) in Biostatistics & Health Data Science (BHDS) delivers rigorous, quantitative knowledge, and statistical and computing skills needed to manage and analyze data to address important questions in public health and biomedical sciences. Students enrolled in the BHDS program are not limited to building quantitative skills only. Instead, students in the BHDS program are asked to enroll in courses in population health to provide a broad context for the quantitative skills they master. Biostatistics & Health Data Science graduates are trained to think critically about nuanced technical, social, and ethical issues arising from the semantics of health data they analyze while appreciating the importance of working with all stakeholders in using data to benefit societal health and well-being.

The BS degree requires a minimum of 120 credits.

COMMUNITY AND GLOBAL HEALTH

The Bachelor of Arts (BA) in Community and Global Health emphasizes conceptual, methodological, and analytical approaches to implementing health services, interventions, and programs in communities. Students study determinants of health including social, biological, environmental, political, and economic and learn to intervene to improve health based on these determinants. The BA emphasizes qualitative research methods, as well as mixed method approaches that combine qualitative with quantitative methods, and underscores the importance of cultural understandings in health within the United States and other nations. Finally, grounded in

interdisciplinarity, the BA degree prepares students to improve global and domestic health outcomes.

The BA degree requires a minimum of 120 credits.

Health, Medicine, and Society

The Bachelor of Arts (BA) in Health, Medicine, and Society (HMS) focuses on the social scientific, humanistic, and applied community-engaged dimensions of health and medical care, developing an understanding of the impact of health, illness, and medical care on individuals, families, cultures, and societies. This program is intended to serve students who wish to be involved in some aspect of the healthcare industry or health policy and also students who are interested in communications, the pharmaceutical industry, law, business, agency work, and other careers where understanding healthcare is essential. This major requires students to declare a second major outside of HMS. The second major can be from any department or program at Lehigh.

The BA degree requires a minimum of 120 credits.

POPULATION HEALTH

The Bachelor of Science (BS) in Population Health degree prepares students to investigate the determinants of health using data science and to identify novel and effective avenues for disease prevention, health promotion, diagnosis, and intervention. Students gain knowledge and skills through coursework, experiential learning opportunities, research projects, and engagement with traditional and nontraditional partners in pursuit of a healthier world. The BS provides students with a strong conceptual background in Population Health as well as extensive methodological expertise in data science and epidemiology.

The BS degree requires a minimum of 120 credits.

UNDERGRADUATE MINORS

Minors offered through the College of Health are open to any Lehigh undergraduate student. Minors can be declared by completing this form (https://powerforms.docusign.net/329016c8-371a-40cf-9ed9-f08c3197cc71/?env=na3&acct=4522e8bc-42ec-46ec-af83-a167d8a26e3f&accountId=4522e8bc-42ec-46ec-af83-a167d8a26e3f&recipientLang=en). For more information, contact the College of Health advising office at cohadvising@lehigh.edu. (cohadvising@lehigh.edu)

Biostatistics	Health Policy & Politics
Community Health	Indigenous Peoples' Health
Epidemiology	Maternal & Child Health
Global Health	Population Health

GRADUATE PROGRAMS

It is more important now than ever to understand, preserve and improve the health and well-being of populations and communities locally, nationally, and globally -- this is at the heart of the mission of Lehigh University's College of Health. The College of Health offers a variety of exceptional graduate education programs that prepare students to investigate and address the multiple determinants of health through novel and innovative health research, practice, and policy. For more information, contact cohgrad@lehigh.edu (%20inchgrad@lehigh.edu).

PHD Population Health	Master of Science in Population Health Management (MS)
Master of Public Health (MPH)	4+1 Accelerated Master of Public Health (MPH)
MBA/MPH (with the College of Business)	4+1 Accelerated Master of Science in Population Health Management (MS)
Graduate Certificate in Population Health	Graduate Certificate Global Population Health
+1 Master of Engineering in Healthcare Systems Engineering (with the P.C. Rossin College of Engineering and Applied Science)	Flex MBA with Healthcare Management Concentration (with the College of Business)

MAJOR PROGRAMS

B.S. IN BIOSTATISTICS & HEALTH DATA SCIENCE

The Biostatistics & Health Data Science program draws on knowledge from many disciplines including mathematics, statistics, computing, and epidemiology, but frames these to the singular applied objective of advancing public health. It spans hypothesis generation, study design, data collection, data storage, data processing, analytic methods development, application and interpretation of analyses, dissemination, and translation. It emphasizes rigor, reproducibility, effective communication, and ethical practices. The major is intended for students who are interested in health, healthcare, and health policy from a data focused perspective, or students who seek to acquire analytic, computational, and data skills within the context of human health.

CORE REQUIREMENTS		**36**
Programming Core		
BSTA 030	Data Exploration in R	
BSTA 040	Data Exploration in Python	
Statistics Core		
BSTA 132	Health Data Science I: Inference	
BSTA 133	Health Data Science 2: Regression	
AI Core		
BSTA 141	Health Data Science III: Supervised Machine Learning in Health	
BSTA 142	Health Data Science IV: Unsupervised Machine Learning in Health	
Health Core		
POPH 001	Introduction to Population and Public Health	
POPH 002	Population Health Research Methods & Application	
EPI 104	Fundamentals of Epidemiology	
EPI 305	Intermediate Epidemiology	
ELECTIVES		**24**
(24 credits from 3 clusters, at least one course from each cluster and a minimum of 6 credits of which are from Data or Methods).		
Elective courses may count towards college distribution requirements.		
Society Cluster		
POPH 003	Justice, Equity, and Ethics in Population Health	
BSTA 007	Frontiers of AI in Health	
CGH 103	Biological & Environmental Determinants of Health	
CGH 104	Sociocultural & Political Determinants of Health	
CGH 105	Commercial Determinants of Health	
CGH 313	Health Policy and Politics	
CGH 332	Aging, Health, and Social Policy	
Data Cluster-all courses have a prerequisite completion of AI Core		
BSTA 372	Analyzing Electronic Health Record Data	
BSTA 373	Analyzing Clinical Natural Language Data	
BSTA 374	Analyzing Health GIS Data	
BSTA 375	Analyzing Health Sensor Data	
BSTA 376	Deep Learning for Healthcare	
Methods Cluster-all courses have a prerequisite completion of Statistics Core		
BSTA 381	Analysis of Dependent Data	
BSTA 383	Survival Analysis	
BSTA 384	Network Analysis	

BSTA 309	Outbreak Science & Public Health Forecasting	
BSTA 386	Bayesian Analysis	
BSTA 387	Analyzing Data in SAS	
Portfolio Project-Concurrent with Data/Methods electives		**1**
BSTA 399	Portfolio Project	
MATH & COMPUTER SCIENCE DISTRIBUTION		**14**
MATH 051	Survey of Calculus I	
MATH 052	Survey of Calculus II	
MATH 043	Survey of Linear Algebra	
CSE 012	Introduction to Programming with Python	
Total Credits		**75**

B.A. IN COMMUNITY AND GLOBAL HEALTH

The major in community and global health emphasizes conceptual, methodological, and analytical approaches to implementing health services, interventions, and programs in communities. Students study determinants of health, including social, biological, environmental, political, and economic and learn to intervene to improve health based on these determinants. The BA emphasizes qualitative research methods, as well as mixed method approaches that combine qualitative with quantitative methods. and underscores the importance of cultural understandings in health within the United States and other nations. Finally, grounded in interdisciplinarity, the BA degree prepares students to improve global and domestic health outcomes.

The BA degree requires a minimum of 120 credits. Students gain an understanding of multiple determinants of health and use a strong foundation in qualitative and quantitative research methods to improve health outcomes in communities both domestically and globally.

Core courses		**18**
CGH 001	Community Health	
CGH 004	Introduction to Global Health	
CGH 101	Careers in Community and Global Health Studies	
CGH 103	Biological & Environmental Determinants of Health	
CGH 104	Sociocultural & Political Determinants of Health	
CGH 105	Commercial Determinants of Health	
Field Experience or Practicum		**6-8**
CGH 301	Community and Global Health Field Experience I	
or CGH 303	Honors Community and Global Health Field Experience I	
CGH 302	Community & Global Health Field Experience II	
or CGH 304	Honors Community and Global Health Field Experience II	
Methods Requirement		**9-12**
One qualitative course, one quantitative course, and one course at the 300-level or above from the list below or in consultation with the advisor.		
BSTA 005	Statistical Literacy in Health	
BSTA 101 & BSTA 102	Population Health Data Science I and Population Health Data Science I Algorithms Lab	
BSTA 103 & BSTA 104	Population Health Data Science II and Population Health Data Science II Algorithms Lab	
CGH 106	Qualitative Methods in Health Research	
CGH 305	Advanced Qualitative Methods in Community and Global Health	
CGH 308	Community Health Intervention Design	
EPI 104	Fundamentals of Epidemiology	
EPI 305	Intermediate Epidemiology	
CGH 375	Community Based Participatory Research Methodology	
Cross-Cultural or Diversity Requirement		**9-12**
A minimum of three courses and 9 credits from the list below or in consultation with the advisor.		
CGH 002	Introduction to LGBTQ2+ Health	
CGH 021	Culture and Health	
CGH 022	Global Perspectives on Health	
CGH 122	Indigenous Healing Traditions	
CGH 311	Religion, Spirituality, and Health	
CGH 322	Contemporary Indigenous Health	
ANTH 155	Medical Anthropology	
Electives		**15-20**
Five electives chosen in consultation with the advisor and must have an applied focus. [2]		
Collateral Requirement		
Foreign Language		
Community and Global Health majors are required to complete the equivalent of two semesters of language study other than English but in the same language. This requirement can be fulfilled using credits from courses taken at Lehigh, from high school AP language tests reported to Lehigh's registrar, from courses taken elsewhere, or some combination of these. If the student is already a fluent speaker in a second language besides English, then the language requirement is waived; fluency will be determined in consultation with faculty from the MLL department.		
Total Credits		**57-70**

1

Graduate courses require special approval.

2

College of Health course prefixes include: BSTA (Biostatistics), EPI (Epidemiology), HIT (Health, Innovation and Technology), HLTH (Health), POPH (Population Health), CGH (Community and Global Health), PUBH (Public Health)*

**PUBH courses are graduate-level and require special permission.*

B.A. in health, Medicine, and society

The Health, Medicine, and Society major is jointly administered by the College of Arts and Sciences and the College of Health. The challenge of meeting the increasingly complex health needs of growing and aging populations is moving to the forefront of national and international concerns in the 21st century. The Interdisciplinary Health, Medicine, and Society Major focuses on the social scientific, humanistic, and applied community-engaged dimensions of health and medical care to develop an understanding of how health, illness, and medical care impact individuals, families, culture, and societies. The joint major is intended to serve students who wish to be involved in some aspect of the healthcare industry, health policy, or public health and also students who are interested in communications, the pharmaceutical industry, law, business, agency work, and other careers where understanding health care is essential.

MAJOR REQUIREMENTS

In addition to the 30-36 required credits, all HMS majors are required to have a second major. [1, 2]		
A minimum of 3 courses must be taken at the 300 level.		
No more than two courses for a maximum of 8 credits may be taken outside of Lehigh, including non-Lehigh study abroad.		
CORE REQUIREMENTS		**14-16**
Health Humanities Core Course		
HMS 170	Medical & Health Humanities	
or HMS/PHIL/ REL/ETH 116	Bioethics	

Behavior, Culture, & Society Core Course		
HMS/PSYC 130	Introduction to Health Psychology	
or HMS/SOC 160	Medicine and Society	
Public Health Core Course		
POPH 001	Introduction to Population and Public Health	
or CGH 001	Community Health	
or CGH 004	Introduction to Global Health	
Health Research Methods Core Course [3]		
POPH 002	Population Health Research Methods & Application	
or BSTA 001	Population Health Data Science I (Releveled to BSTA 101)	
or BSTA 005	Statistical Literacy in Health	
or CGH 106	Qualitative Methods in Health Research	
CONCENTRATIONS [4]		**9-12**
Students must take a minimum of 3 courses outside of the core requirements in one of the following concentrations:		
Health Humanities		
or		
Behavior, Culture, & Society		
or		
Public Health & Policy		
Please see below for lists of concentration courses.		
ELECTIVE REQUIREMENTS [4]		**6-8**
Take any 2 additional HMS courses (at least one of which must be outside of the selected concentration)		

[1]

Students are required to meet the distribution requirements of the college they were admitted to, either the College of Health or the College of Arts & Sciences.
If a student pursues the required second major as a B.A. through another college, they are required to fulfill the distribution requirements listed for a CAS/CoH B.A.+B.A . Students who pursue a combination of a B.A.+ B.S. are required to petition for a dual degree.

[2]

No more than two courses outside of the core courses can come from cross-listed courses within the second major, and no more than 3 courses can double-count towards both majors regardless of home college.

[3]

Research methods required course should be chosen in consultation with Advisor. Major dependent courses that may meet this requirement include SOC 211 Research Methods and Data Analysis, PSYC 202 Research Methods and Data Analysis II, IR 100 Methods and Research Design, ECO 045 Statistical Methods, and BIOS 130 Biostatistics.

[4]

A maximum of 4 credits of HMS 221 Peer Education Foundations, HMS 271 Independent Study, HMS 292 Supervised Research, HMS 293 Internship , or HMS 294 Health Equity Internship may fulfill the major elective or major concentration requirements.

CONCENTRATION AND ELECTIVE COURSES

A complete list of course offerings can be found each semester on the College of Health (https://health.lehigh.edu/academics/course-offerings/) and HMS (https://hms.cas.lehigh.edu/content/course-offerings/) websites. Other elective courses may be approved at the discretion of the program director.

HEALTH HUMANITIES CONCENTRATION

Take Three		
HMS/REL/ETH 002	Death and Dying: Religious and Ethical Perspectives	
HMS/ETH/PHIL/REL 106	Bioethics and the Law	
HMS/ENGL 115	Topics in Literature, Medicine, and Health	
HMS/HIST 118	History of Modern Medicine	
HMS 142	The Greek and Latin Roots of Medical Terminology	
HMS/FILM 166	Topics in Film and Health	
HMS/AAS/HIST/GS 176	Keeping Africa and Africans Healthy: A History of Illness and Wellness	
HMS/REL/ETH 226	From Black Death to Covid-19:Plague,Pandemic,Ethics and Religion	
HMS/MLL 257	Traditional Chinese Medicine: Historical Perspectives	
HMS/SPAN/LAS 270	Spanish for the Health Professions	
HMS/ENGL 315	Topics in Literature, Medicine, and Health	
POPH 003	Justice, Equity, and Ethics in Population Health	
POPH 319	Population Health Bioethics	
Total Credits		**10-12**

BEHAVIOR, CULTURE, & SOCIETY CONCENTRATION

Take Three		
HMS/POLS/EVST 110	Environmental Planning for Healthy Cities	
HMS/HIST/WGSS 125	Does Sex have a History? The History of Sexuality in the United States	
HMS/PSYC 138	Psychopathology	
HMS/COMM 150	Health Communication	
HMS/ANTH/GS 155	Medical Anthropology	
HMS/SOC 162	HIV/AIDS and Society	
HMS/PSYC 302	Stress and Coping	
HMS/AAS/GS/SOC 314	Infections and Inequalities: HIV, TB and Malaria in the Global South	
HMS/PSYC 319	The Psychology of Trauma	
HMS/EVST/POLS 320	Food Justice in Urban Environments	
HMS/SOC/GS 322	Global Health Issues	
HMS/JOUR/EVST 323	Health and Environmental Controversies	
HMS 327/327/PSYC 327	Advanced Topics in Health Psychology	
HMS/PSYC/WGSS 334	The Psychology of Body Image and Eating Disorders	
HMS/PSYC 344	Health Care Reasoning and Decision Making	
HMS/PSYC 348	Drugs and Behavior	
HMS/PSYC 386	Pediatric Psychology	
ECO 368	Health Economics	
Total Credits		**11-12**

PUBLIC HEALTH & POLICY CONCENTRATION

Take Three		
HMS 221	Peer Education Foundations	
HMS/POLS 307	The Politics of Mental Health Policy	
HMS/POLS 354	U.S. Health Care Politics	
CGH 004	Introduction to Global Health	
CGH 105	Commercial Determinants of Health	
CGH 107	What is the US Healthcare Ecosystem?	
CGH 305	Advanced Qualitative Methods in Community and Global Health	
CGH 306	Mixed Methods in Health Research	

CGH 307	Health Survey Research Methods	
CGH 308	Community Health Intervention Design	
CGH 313	Health Policy and Politics	
CGH 316	Global Environmental Disasters & Policy	
CGH 331	Healthcare Finance	
CGH 332	Aging, Health, and Social Policy	
CGH/HMS/EDUC 375	Community Based Participatory Research Methodology	
EPI 104	Fundamentals of Epidemiology	
EPI 305	Intermediate Epidemiology	
EPI 306	Lifecourse Epidemiology	
POPH 105	Introduction to Maternal and Child Health	
Total Credits		**9-12**

OTHER COURSES AND ELECTIVES

BIOS 010	Bioscience in the 21st Century	3
EES 029	Human Health and the Environment	3
HMS 090	Freshman Seminar	1-4
CGH 103	Biological & Environmental Determinants of Health	4
POPH 106	Global Environment and Human Welfare	3
CGH 120	Independent Study or Research in Community and Global Health	1-4
POPH 120	Independent Study or Research in Population Health	1-4
CGH 130	Internship in Community and Global Health	1-4
POPH 130	Internship in Population Health	1-4
CGH 150	Special Topics in Community and Global Health	3-4
POPH 150	Special Topics in Population Health	3-4
HMS 291	Special Topics	1-4
HMS 292	Supervised Research	1-8
HMS 293	Internship	1-8
BSTA 308	Advanced R Programming	3
EPI 310	Environmental Epidemiology & Exposure Science	3
CGH 315	Medical Mysteries	3
CGH 330	Internship in Community and Global Health	1-4
POPH 330	Internship in Population Health	1-4
CGH 350	Special Topics in Community and Global Health	3-4
POPH 350	Special Topics in Population Health	3-4

B.S. IN POPULATION HEALTH

The major in population health prepares students to investigate the determinants of health using data science and to identify novel and effective avenues for disease prevention, health promotion, diagnosis, and intervention. Students gain knowledge and skills through coursework, experiential learning opportunities, research projects, and engagement with traditional and nontraditional partners in pursuit of a healthier world. The BS provides students with a strong conceptual background in Population Health as well as extensive methodological expertise in data science and epidemiology.

The BS in Population Health requires a minimum of 120 credits. Students gain a strong conceptual background in Population Health as well as extensive methodological expertise in data science and epidemiology.

Core Requirement		
POPH 001	Introduction to Population and Public Health	4
POPH 002	Population Health Research Methods & Application	4
POPH 104	Careers in Population Health	3
EPI 104	Fundamentals of Epidemiology	3
EPI 305	Intermediate Epidemiology	3
CGH 307	Health Survey Research Methods	3
Data Science Requirement [1]		
BSTA 101 & BSTA 102	Population Health Data Science I and Population Health Data Science I Algorithms Lab	4
BSTA 103 & BSTA 104	Population Health Data Science II and Population Health Data Science II Algorithms Lab	4
One additional upper-level methods course chosen in consultation with adviser.		3-4
Determinants of Health (choose 2)		**8**
CGH 103	Biological & Environmental Determinants of Health	
CGH 104	Sociocultural & Political Determinants of Health	
CGH 105	Commercial Determinants of Health	
Capstone Project		**6-8**
POPH 301	Population Health Capstone (Proposal)	
or POPH 305	Honors Population Health Capstone (Proposal)	
POPH 302	Population Health Capstone (Execution)	
or POPH 306	Honors Population Health Capstone (Execution)	
Electives		**15-20**
5 electives chosen in consultation with an adviser. [2]		
Total Credits		**60-68**

1

MATH 051 Survey of Calculus I or equivalent recommended

2

College of Health course prefixes include: BSTA (Biostatistics), CGH (Community and Global Health), EPI (Epidemiology), HIT (Health, Innovation and Technology), HLTH (Health), POPH (Population Health), and PUBH (Public Health)*

**PUBH courses are graduate-level and require special permission.*

PLAN OF STUDY FOR PRE-HEALTH STUDENTS

Many College of Health students enter Lehigh with a plan to continue graduate-level work in a health-related discipline. Pre-health students at Lehigh can major in any area, provided they also complete the prerequisite coursework set forth by the medical, dental, or other professional programs they are interested in. Students interested in attending medical school or other health-related schools should contact The Center for Career & Professional Development (https://careercenter.lehigh.edu/) (careercenter@lehigh.edu (careerservices@lehigh.edu)) and ask to be enrolled in the Pre-Health Advising Course Site. The proposed plan of study below should be discussed with your adviser. *Please note that pre-health prerequisites cannot be applied as major electives but will instead be listed as free electives on your transcript.*

First Year

Fall	CR	Spring	CR
WRT 001 or 003	3	(1) course to fulfill major requirements	3
MATH 051	4	WRT 002 or 005	3
CHM 030	4	MATH 052	3
First-year seminar		CHM 031 or 041	4

		BIOS 041 & BIOS 042[1]	4
	11		**17**

Second Year

Fall	CR	Spring	CR
(1) Course to fulfill major requirements	3	(2) Courses to fulfill major requirements	6-8
CGH 104[2]	4	CGH 021[2]	3
CHM 110 & CHM 111	4	BSTA 101 & BSTA 102[3]	3
BIOS 115 & BIOS 116	4	CHM 112 & CHM 113	4
PSYC 001	4		
	19		**16-18**

Third Year

Fall	CR	Spring	CR
(1) Course to fulfill major requirements	3-4	(3) Courses to fulfill major requirements	9-12
CGH 101 or POPH 104	3	PHY 013 & PHY 022	4
PHY 010 & PHY 012	4	BIOS 372	3
BIOS 044 & BIOS 045	4		
BIOS 371	3		
	17-18		**16-19**

Fourth Year

Fall	CR	Spring	CR
(4) Courses to fulfill major requirements	12-15	(3) Courses to fulfill major requirements	9-12
Major capstone or field/ practicum experience	3-4	Major capstone or field/ practicum experience	3-4
	15-19		**12-16**

Total Credits: 123-137

1

First-year students accepted into the SEA-PHAGES program will enroll in BIOS 043 Phage Hunting Laboratory Phage Hunting Laboratory lab instead of BIOS 042 Introduction to Cellular and Molecular Biology Laboratory.

2

Recommended courses to prepare students for the sociology section of MCAT include CGH 104 Sociocultural & Political Determinants of Health and CGH 021 Culture and Health. Students are encouraged to use these courses toward their major requirements.

3

BSTA 005 Statistical Literacy in Health or BSTA 101 Population Health Data Science I & BSTA 102 Population Health Data Science I Algorithms Lab fulfills the statistics MCAT requirement.

4+1 ACCELERATED PROGRAMS

Qualified students can earn an MS in Population Health Management or an MPH (Master of Public Health) at an accelerated pace. Students accepted into the 4+1 accelerated program begin taking graduate classes during their junior and senior years and can complete the program one year after graduating with their undergraduate degree. Current Lehigh students who have a minimum overall GPA of 3.5 may be automatically accepted into the 4+1 accelerated program once they have achieved junior standing, a minimum of 54 credits. Students in these programs who do not qualify for direct admittance based on their GPA are welcome to apply for acceptance.

Students interested in learning more about the 4+1 programs are encouraged to reach out to the College of Health advising office at cohadvising@lehigh.edu or submit their intention to declare here (https://docs.google.com/forms/d/e/1FAIpQLScGcjGiBCBXFd2m-_0LU9r7lSx-q_gSCGULzRGn1L8jCFgUnQ/viewform/?usp=sf_link).

Benefits of the 4+1 program include:

- 30% tuition discount on graduate tuition;
- No application process for students with an overall GPA of 3.5 or better;
- Completion up to 4 graduate courses while an undergraduate student;
- A savings of more than 40% off the total cost of the graduate degree;
- Fulfillment of the MS or MPH degree requirements in 1/2 the time.

MINOR PROGRAMS

Minor programs in the College of Health are open to students from across the university. Students who have completed courses in their major that are also required for a minor may only count one course for both.

For more information, contact the College of Health at cohadvising@lehigh.edu. To declare any minor offered by the College of Health, complete this form (https://powerforms.docusign.net/329016c8-371a-40cf-9ed9-f08c3197cc71/?env=na3&acct=4522e8bc-42ec-46ec-af83-a167d8a26e3f&accountId=4522e8bc-42ec-46ec-af83-a167d8a26e3f&recipientLang=en).

BIOSTATISTICS

The Biostatistics minor provides quantitatively oriented students with conceptual knowledge and hands-on skills in applied statistics and data science techniques commonly employed in the field of biostatistics. The curriculum seeks to prepare students to interpret and contribute to quantitative research in health-related fields, including community and population health. The minor serves to broaden student employment possibilities post-Lehigh while making them more competitive as applicants to health-related graduate programs that favor prior training in applied statistics.

BSTA 101 & BSTA 102	Population Health Data Science I and Course BSTA 102 Not Found	4
BSTA 103 & BSTA 104	Population Health Data Science II and Population Health Data Science II Algorithms Lab	4
Electives (choose 3 from the list below, or in consultation with your adviser)		9
BSTA 305	Population Health Data Science III	
BSTA 306	Population Health Data Science III Algorithms Lab	
BSTA 307	Applied Machine Learning for Health Sciences	
BSTA 308	Advanced R Programming	
BSTA 309	Outbreak Science & Public Health Forecasting	
BSTA 320	Independent Study or Research in Biostatistics	
Total Credits		**17**

COMMUNITY HEALTH

The minor in community health is for students **not** pursuing a major in community and population health. Students explore the multiple determinants of health and learn how to take a qualitative approach to investigate these determinents.

Core Requirement		
CGH 001	Community Health	3
Methods Requirement (choose one)		**3-4**
BSTA 005	Statistical Literacy in Health	

CGH 106	Qualitative Methods in Health Research	
BSTA 101 & BSTA 102	Population Health Data Science I and Course BSTA 102 Not Found	
Determinant Class (choose one)		**4**
CGH 103	Biological & Environmental Determinants of Health	
CGH 104	Sociocultural & Political Determinants of Health	
CGH 105	Commercial Determinants of Health	
Two electives, including at least one cross-cultural, at least one 300-level		6-8
Total Credits		**16-19**

Epidemiology

The minor in epidemiology provides students with conceptual knowledge and hands-on skills necessary to measure human health among populations. Students can use this knowledge in their daily lives and in practical application to their major field of study. These skills are essential to health-related fields, including community and population health, and medicine, and are increasingly attractive in the fields of business, engineering, biological or social sciences, especially as populations prepare for and mitigate emerging chronic and infectious diseases.

Core courses		
EPI 104	Fundamentals of Epidemiology [1]	3
EPI 305	Intermediate Epidemiology [2]	3
Choose 3 electives at the 300 level from the list below:		
EPI 306	Lifecourse Epidemiology	
EPI 308	Spatial Epidemiology	
EPI 309	Chronic Disease Epidemiology	
EPI 310	Environmental Epidemiology & Exposure Science	
EPI 311	Psychiatric Epidemiology and Global Mental Health	
BSTA 309	Outbreak Science & Public Health Forecasting	
Or another in consultation with adviser		
Total credits		**15-18**

1 & 2

Students who have taken EPI 104 and EPI 305 for their major can only count **one** of these courses toward the EPI minor; for the other, they would need to replace it with another comparable course (selected in consultation with an adviser) that is at least 3 credits.

GLOBAL HEALTH

The minor in global health is for students **not** pursuing a major in community and population health. Students in the Global Health minor will gain an understanding of global health concerns and their determinants and comparative approaches for health promotion, disease prevention, and health care delivery in the international sphere.

CGH 004	Introduction to Global Health	3
POPH 106	Global Environment and Human Welfare	3
Field or Research Experience [1]		3-4
Two electives in consultation with adviser. One elective must be at the 300-level.		6-8
Total Credits		**15-18**

1

Approved Field or Research Experience courses include POPH 120 Independent Study or Research in Population Health, POPH 130 Internship in Population Health, POPH 320 Independent Study or Research in Population Health, POPH 330 Internship in Population Health, CGH 120 Independent Study or Research in Community and Global Health, CGH 130 Internship in Community and Global Health, CGH 320 Independent Study or Research in Community and Global Health, CGH 330 Internship in Community and Global Health, CINQ 387 Creative Inquiry Projects, CINQ 389 Inquiry to Impact Group Projects or other credit or non-credit experience chosen in consultation with the adviser. In the event that a student pursues a non-credit bearing field experience, the student will be required to fulfill the credit requirements for the minor by choosing an additional elective.

HEALTH POLICY & POLITICS

The minor in health policy & politics is intended for students interested in receiving more advanced training and experiences in healthcare policy-making processes and the political factors that influence this process. Courses introduce the theoretical and empirical approaches to understanding the different phases of the policy-making process; the important roles that politicians, bureaucrats, and civil society play in the design and implementation of policy; as well as the role of the international community, such as the World Health Organization (WHO).

CGH 004	Introduction to Global Health	3
CGH 313	Health Policy and Politics	3
Determinant Class (choose one)		**3-4**
CGH 104	Sociocultural & Political Determinants of Health	
CGH 105	Commercial Determinants of Health	
Field or Research Experience [1]		3-4
Two electives in consultation with adviser. One elective must be at the 300-level.		6-8
Total Credits		**18-22**

1

Approved Field or Research Experience courses include POPH 120 Independent Study or Research in Population Health, POPH 130 Internship in Population Health, POPH 320 Independent Study or Research in Population Health, POPH 330 Internship in Population Health, CGH 120 Independent Study or Research in Community and Global Health, CGH 130 Internship in Community and Global Health, CGH 320 Independent Study or Research in Community and Global Health, CGH 330 Internship in Community and Global Health, CINQ 387 Creative Inquiry Projects, CINQ 389 Inquiry to Impact Group Projects or other credit or non-credit experience chosen in consultation with the adviser. In the event that a student pursues a non-credit bearing field experience, the student will be required to fulfill the credit requirements for the minor by choosing an additional elective.

INDIGENOUS PEOPLES HEALTH

The undergraduate minor in Indigenous peoples health will provide students with a basic understanding of the concepts and perspectives needed to work with the Indigenous peoples of the Americas and their communities. Through their coursework students will learn about issues such as sovereignty, colonialism, historical trauma, and the connections these concepts play in the health disparities, inequalities, and inequities Indigenous peoples face today. Students will also learn the basics of developing and implementing health programs with Indigenous peoples and their communities.

Core courses		
CGH 122	Indigenous Healing Traditions	3
CGH 322	Contemporary Indigenous Health	3
Experiential Learning Component		

POPH 120	Independent Study or Research in Population Health	3-4
or POPH 320	Independent Study or Research in Population Health	
Electives (choose 2 from this list below or in consultation with the advisor)		**6**
CGH 004	Introduction to Global Health	
CGH 021	Culture and Health	
CGH 104	Sociocultural & Political Determinants of Health	
CGH 151	Special Topics in Indigenous Peoples Health	
CGH 351	Special Topics in Indigenous Peoples Health	
POPH 003	Justice, Equity, and Ethics in Population Health	
POPH 106	Global Environment and Human Welfare	
HMS/EDUC 375	Community Based Participatory Research Methodology	
Total Credits		**15-16**

MATERNAL & CHILD HEALTH

The maternal and child Health minor provides students with a deeper understanding of the lifecourse approach as well as the multiple determinants that shape the health and wellbeing of women, children, and families across the life course and intergenerational. Students apply these foundational concepts to evaluate maternal and child health research, programs, and policies in the US and globally.

POPH 001	Introduction to Population and Public Health	3
or CGH 001	Community Health	
POPH 105	Introduction to Maternal and Child Health	3
EPI 306	Lifecourse Epidemiology	3
Electives (two courses chosen in consultation with the advisor)		6-8
Total Credits		**15-17**

POPULATION HEALTH

The minor in population health is for students **not** majoring in population health. The minor program provides students with an overview of the data science approach to investigating the multiple determinants of health.

POPH 001	Introduction to Population and Public Health	4
POPH 002	Population Health Research Methods & Application	4
BSTA 001 & BSTA 002	Population Health Data Science I and Population Health Data Science I Algorithms Lab	4
EPI 104	Fundamentals of Epidemiology	3
Elective chosen in consultation with the adviser		3-4
Total Credits		**18-19**

DOCTORAL PROGRAM

PHD IN POPULATION HEALTH

Lehigh University's Doctor of Philosophy (Ph.D.) in Population Health degree prepares doctoral students to investigate, integrate, and address health determinants using data science and develop novel and effective avenues for disease diagnosis and prevention, health promotion, and intervention. The program combines foundational courses in population health with additional data science, qualitative research methods, population health survey methods, research ethics, and policymaking. By providing a strong disciplinary and methodological foundation in Population Health through coursework, experiential learning opportunities, research projects, and engagement with traditional and non-traditional partners to pursue a healthier world, the Ph.D. program prepares students to pursue an independent line of inquiry and develop their own body of research.

The Ph.D. degree requires a minimum of 72 credits. During the last semester of coursework, students will complete the qualifying exam, developed by the doctoral adviser and secondary faculty mentor. Once students pass the qualifying exam, they will work closely with their doctoral committee to complete the dissertation proposal and dissertation defense stages.

Core Requirements		**27**
HLTH 400	Philosophical and Theoretical Foundations of Population Health	
POPH 401	Population Health Concepts and Methods	
POPH 403	Biological Basis of Population Health: Concepts and Methods	
POPH 405	Qualitative Research Methods	
POPH 409	Social Determinants of Health	
HLTH 412	Research Ethics in Population Health	
HLTH 416	Grant Writing	
BSTA 402	Biostatistics in Health	
HLTH 417	Teaching Community and Population Health	
EPI 404	Methods in Epidemiology I	
Methods or Electives		**27**
Twelve graduate-level courses, a minimum of 36 credits, chosen in consultation with an adviser. Students are encouraged to take courses that will provide them with additional expertise in substantive and/or methodological areas of interest; three of these courses must focus on a methodological area of interest. Courses taken outside the College of Health must be approved by an advisor.		
Population Health Dissertation Proposal [1]		**1-8**
HLTH 482	Population Health Dissertation Proposal	1-8
Students will work closely with their doctoral advisor and doctoral committee to develop their dissertation proposal. Students will orally defend their dissertation proposal to their doctoral committee and will need to obtain approval before proceeding to the dissertation phase.		
Population Health Dissertation [2]		**1-8**
HLTH 499	Population Health Dissertation	1-8
Students will work closely with their doctoral advisor and doctoral committee to complete their dissertation project. Students will be required to pass their dissertation defense and incorporate feedback from the committee in order to meet the graduation requirements for the doctoral degree.		
Total Minimum Credits		**72**

1

If students complete 72 credits beyond the undergraduate degree and prior to advancing to candidacy, they need to be enrolled in at least 3 credit hours per semester.

2

After completion of 72 credits beyond the bachelor's degree, students are permitted to register for 'Maintenance of Candidacy' and will be charged a single credit hour of graduate tuition per semester.

MASTER PROGRAMS

MASTER OF PUBLIC HEALTH (MPH)

Lehigh University's Master of Public Health (MPH) degree is a generalist degree that prepares students to work in a variety of local, state, national, and global public health research, practice, and policymaking settings. Students gain expertise in the core domains of public health, investigate and address the determinants of health using data science, and develop novel and effective avenues for disease prevention and health promotion. The program combines foundational courses in public health with additional courses in data science, qualitative research methods, leadership,

cultural understanding and health, and policymaking. Students gain knowledge and skills through coursework, experiential learning opportunities, research projects, and engagement with traditional and non-traditional partners to pursue a healthier world. The MPH program is designed to meet the Council on Education for Public Health (CEPH) accreditation requirements. The MPH degree requires a minimum of 42 credits.

Core Requirements [1]		
BSTA 402	Biostatistics in Health [2]	3
EPI 404	Methods in Epidemiology I	3
POPH 405	Qualitative Research Methods	3
PUBH 401	Health Promotion and Education	3
PUBH 402	Health Services, Administration, Politics, and Policy	3
PUBH 403	Health Program Planning and Implementation	3
PUBH 405	Program Evaluation Methods	3
POPH 409	Social Determinants of Health	3
Generalist Requirements		
POPH 431	Environmental Health Justice	3
EPI 405	Methods in Epidemiology II	3
BSTA 403	Health Applications in Statistical Learning	3
Elective [1]		
Students are encouraged to take an elective that will provide them with additional expertise in a substantive or methodological area of interest. Electives can be taken outside the College of Health, but adviser approval is required.		3
Practicum and Capstone		
PUBH 410	Applied Practice Experience	3
PUBH 411	Public Health Capstone	3
Total Credits		**42**

1

For students enrolled in the 4+1 accelerated BS/MPH or BA/MPH program, courses taken during the student's undergraduate degree cannot be applied as an undergraduate degree requirement.

2

If the student has taken BSTA 101/102 and BSTA 103/104 at the undergraduate level, replace BSTA 402 with an adviser-approved elective.

MASTER OF Science in POPULATION HEALTH Management (MS)

Lehigh University's Master of Science (MS) in Population Health Management degree prepares graduate students to investigate and address health determinants using data science and develop novel and effective avenues for disease diagnosis and prevention, health promotion, and intervention. The program combines foundational courses in population health with additional data science, qualitative research methods, population health survey methods, research ethics, and policymaking. Students gain knowledge and skills through coursework, experiential learning opportunities, research projects, and engagement with traditional and non-traditional partners to pursue a healthier world. The MS degree requires a minimum of 33 credits.

Core Requirements [1]		
POPH 401	Population Health Concepts and Methods [2]	3
POPH 403	Biological Basis of Population Health: Concepts and Methods	3
POPH 409	Social Determinants of Health	3
PUBH 402	Health Services, Administration, Politics, and Policy	3
CGH 335	Healthcare Operations Management	3
CGH 331	Healthcare Finance	3
BSTA 402	Biostatistics in Health	3
Select one other 400-level BSTA course		3
BSTA 403	Health Applications in Statistical Learning	
BSTA 404	Data Architecture, Mining, and Linkage	
EPI 404	Methods in Epidemiology I	3
POPH 405	Qualitative Research Methods	3
POPH 410	Population Health Capstone/Thesis Project	3
Total Credits		**33**

1

For students enrolled in the 4+1 accelerated BS/MS program or BA/MS program, courses taken during the student's undergraduate degree cannot be double-counted as an undergraduate degree requirement.

2

4+1 students who have taken BSTA 101/102 and BSTA 103/104 as undergraduates should not take BSTA 402 but will still need to fulfill those three credits with another quantitative course approved by advisor.

4+1 ACCELERATED PROGRAMS

Qualified students can earn an MS in Population Health Management or an MPH (Master of Public Health) at an accelerated pace. Students accepted into the 4+1 accelerated program begin taking graduate classes during their junior and senior years and can complete the program one year after graduating with their undergraduate degree. Current Lehigh students who have a minimum overall GPA of 3.5 may be automatically accepted into the 4+1 accelerated program once they have achieved junior standing, a minimum of 54 credits. Students in these programs who do not qualify for direct admittance based on their GPA are welcome to apply for acceptance.

Students interested in learning more about the 4+1 programs are encouraged to contact the College of Health graduate advising at cohgrad@lehigh.edu (cohadvising@lehigh.edu).

Benefits of the 4+1 program include:

- 30% tuition discount on graduate tuition;
- No application process for students with an overall GPA of 3.5 or better;
- Completion of up to 4 graduate courses while an undergraduate student;
- A savings of more than 40% off the total cost of the graduate degree;
- Fulfillment of the MS or MPH degree requirements in 1/2 the time.

GRADUATE CERTIFICATES

POPULATION HEALTH CERTIFICATE

The graduate certificate in population health will prepare students to learn and apply graduate-level introductory Population Health concepts and methodology. The 12 credits earned in this certificate program can be applied to either the Master of Public Health (MPH) or the Master of Science (MS) in Population Health Management.

POPH 401	Population Health Concepts and Methods	3
EPI 404	Methods in Epidemiology I	3
BSTA 402	Biostatistics in Health	3
or POPH 405	Qualitative Research Methods	
Elective chosen in consultation with the advisor.		3-4
Total Credits		**12-13**

GLOBAL HEALTH CERTIFICATE

The graduate certificate in Global Health prepares students to be global and population health leaders through research, education, and experiential learning, both domestically and internationally. Students who participate in the graduate Global Health certificate

will have a strong interest in examining the ways health disparities and specific risk factors affect local and global populations. The graduate certificate in Global Health aims to provide students with skills to evaluate global health programs and design evidence-based interventions. To function well in the field of global health, students must be able to recognize cultural differences, consider social inequalities, and work with diverse groups. A large focus is also on the ethics of global health research and interventions. The graduate certificate program aims to help prepare students for a wide array of potential career paths in global health or population health. The 12 credits earned in this certificate program can be applied toward either the MPH or the MS in Population Health Management.

POPH 413	Foundations of Global Health	3
POPH 414	Global Health Research or Field Experience	3
BSTA 402	Biostatistics in Health	3
or POPH 405	Qualitative Research Methods	
Elective chosen in consultation with the adviser.		3
Total Credits		**12**

JOINT PROGRAMS

1-MBA and MPH Dual Degree Program

The 1-MBA and Master of Public Health (MPH) dual degree program (https://business.lehigh.edu/academics/graduate/masters-programs/one-year-mba/mph-dual-degree/) offers participating students the opportunity to gain strong strategic business skills with a focus on public health. The 1-MBA/MPH dual degree program enables students interested in the Biotechnology, Pharmaceutical, Occupational Health, and Health Care industries to complete two complimentary degrees within a two-year timeframe.

Flex MBA with HealthCARE MANAGEMENT Concentration

The College of Business FLEX MBA (https://business.lehigh.edu/academics/graduate/masters-programs/flex-mba/about-program/curriculum/) is a 36-credit program with combined core and elective coursework. Students choosing the healthcare management concentration will take four graduate courses in the College of Health chosen in consultation with an adviser.

4+1 MASTER OF ENGINEERING IN HEALTHCARE SYSTEM ENGINEERING

The P.C. Rossin College of Engineering and Applied Science Healthcare Systems Engineering Master Program (https://engineering.lehigh.edu/hse/academics-degree-options/master-engineering/) uses systems modeling and analytics tools coupled with a broad overview of systems of healthcare to enable students to address complex operational challenges. Students encounter a variety of tools, including: project management, engineering economics, statistics and stochastic modeling, operations research and optimization, process flow and queuing, simulation and information systems analysis and design. The program places a strong emphasis on applied learning and professional development, with relevant projects and assignments woven throughout the curriculum. Students enrolled in the 4+1 program associated with the College of Health take four graduate-level courses in COH chosen in consultation with an adviser.

Biostatistics Courses

BSTA 001 Population Health Data Science I 3 Credits

Students will learn the fundamentals of probability theory, univariate statistics, statistical computing/programming/visualization, and machine learning. A mix of traditional and experiential learning will focus on how to build an analysis pipeline to answer pressing questions in population health. In-class examples and projects will use real data sets. Students will propose a small data-driven project focused in population health, and use their newly-acquired data science skills to collect, analyze, and present their work. Must be taken in conjunction with BSTA 002.
Corequisites: BSTA 002

BSTA 003 Computational Thinking 3 Credits

This course introduces computational thinking as a problem-solving methodology in health and biological sciences. You will explore the approach of developing theoretical models for natural events and converting them into computer simulations using tools like R, Python, MATLAB, or SAS. The course emphasizes fundamental programming concepts, making it suitable for beginners, while also highlighting computational thinking in health. Additionally, the course explores ethics in computational science, covering responsible algorithmic decision-making, data management, privacy, bias, and transparency in computing.

BSTA 005 Statistical Literacy in Health 3 Credits

This course is designed to introduce students with a fear of all things mathematical to the importance of statistics in health research. Students will learn how to read and understand basic statistical concepts and methods used in health research, such as probability, sampling, hypothesis testing, and correlation. Students will also learn to interpret tables and statistical findings in the health literature.

BSTA 007 (POPH 007) Frontiers of AI in Health 3 Credits

This course presents a broad contemporary survey of the actual and potential contributions of Artificial Intelligence and Health Data Science in addressing public health challenges. By reading recent articles that describe case studies of AI in health and healthcare and by engaging in discussions both in class and online, students will come to appreciate the many unsolved problems in public health and how one may evaluate the potential benefits and risks of exciting new data-centric solutions made possible by AI.

BSTA 030 Data Exploration in R 3 Credits

This course provides an introduction to problem-solving using the R environment for statistical computing and graphics. Students will gain experience designing, implementing, and testing their R code. Multiple programming paradigms will be explored. The course covers R data types, input and output, and control flow in the context of preparing, cleaning, transforming, and manipulating data. Students will use R to conduct exploratory data analyses, including computing descriptive statistics and data visualization. Students should expect to spend each class writing programs.
Prerequisites: CSE 012

BSTA 040 Data Exploration in Python 3 Credits

This course provides an introduction to the fundamentals of programming in Python. Students will gain experience designing, implementing, and testing their Python code, as well as in using Jupyter Notebooks, and IPython for statistics and data analysis. Multiple programming paradigms will be explored. The course covers Python data types, input, and output, and control flow in the context of preparing, cleaning, transforming, and manipulating data. In addition, students will use Python to conduct exploratory data analyses, including computing descriptive statistics.
Prerequisites: CSE 012

BSTA 101 Population Health Data Science I 3 Credits

This course provides an introduction to the use of statistics in health. Topics include data presentation, descriptive statistics, probability and probability distributions, parameter estimation, hypothesis testing, analysis of contingency tables, analysis of variance, linear and logistic regression models, and sample size and power considerations. Students develop the skills necessary to perform, present, and interpret basic statistical analyses. Must be taken in conjunction with BSTA 102.
Corequisites: BSTA 102

BSTA 102 Population Health Data Science I Algorithms Lab 1 Credit

Students will use a statistical computing platform to apply concepts learned in BSTA 101 and attain autonomy in handling real-world data. Lab must be taken concurrently with lecture (BSTA 101 Population Health Data Science I).
Corequisites: BSTA 101

BSTA 103 Population Health Data Science II 3 Credits
This course is a continuation of BSTA 101. Topics include an overview of generalized linear models, simple and multiple linear regression, regression models for binary data, regression models for count data, quasi-likelihood methods, extensions of generalized linear models. Must be taken in conjunction with BSTA 104. Prerequisites: BSTA 101.
Prerequisites: BSTA 101
Corequisites: BSTA 104

BSTA 104 Population Health Data Science II Algorithms Lab 1 Credit
Students will use a statistical computing platform to apply regression techniques learned in BSTA103 Population Health Data Science II to health datasets. Lab must be taken concurrently with lecture (BSTA103 Population Health Data Science II).
Prerequisites: BSTA 101
Corequisites: BSTA 103

BSTA 120 (CGH 120, EPI 120, POPH 120) Independent Study or Research 1-4 Credits
This course can be directed readings or research in Biostatistics or an experiential learning experience that puts student's understanding of Biostatistics into practice. Department permission required.
Repeat Status: Course may be repeated.

BSTA 130 Internship 1-4 Credits
In this introductory course, students will engage in supervised work in Biostatistics. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

BSTA 132 Health Data Science I: Inference 4 Credits
This course provides an introduction to methods of statistical inference as applied to health data. Topics covered include hypothesis testing, confidence intervals, analysis of variance, correlation, and non-parametric methods. The course will illustrate these concepts using data from the health context. In addition to traditional methods of learning, computing will be a significant component of the course, ensuring students acquire the skills to both formulate and answer pressing questions in population health.
Prerequisites: MATH 052 and MATH 043 and BSTA 030

BSTA 133 Health Data Science 2: Regression 4 Credits
This course provides an introduction to generalized linear models as applied to health data. Topics covered include models for binary data, models for nominal and ordinal data, models for count data, quasi-likelihood methods, and Bayesian generalized linear models. The course will illustrate these concepts using data from the health context. In addition to traditional methods of learning, computing will be a significant component of the course, ensuring students acquire the skills to both formulate and answer pressing questions in population.
Prerequisites: BSTA 132

BSTA 141 Health Data Science III: Supervised Machine Learning in Health 4 Credits
Supervised machine learning is used to create automated systems that sift through labeled/continuous data at high speed to make predictions with minimal human intervention. This course provides students with skills in applying supervised machine learning in contexts of population health. We will cover regression, classification, cross-validation, hyperparameter selection, feature selection, feature engineering, ensemble methods, regularization, and reinforcement learning. Students will learn concepts through hands-on engagement with health data sets, preparing them to contribute effectively to data-driven precision population health.
Prerequisites: MATH 052 and MATH 043 and BSTA 040

BSTA 142 Health Data Science IV: Unsupervised Machine Learning in Health 4 Credits
Unsupervised machine learning is used to discover hidden patterns and structures in high-dimensional unlabeled health data. This course will survey leading techniques for clustering and dimensionality reduction. The course will cover hierarchical and density-based clustering techniques, along with modeling using Gaussian mixtures, factor analysis, and principal component analysis. Applications considered will include patient clustering for personalized treatment, anomaly detection for early disease identification, and dimensionality reduction for efficient analysis of diverse and complex medical datasets.
Prerequisites: BSTA 141 and MATH 052 and MATH 043 and BSTA 040

BSTA 150 Special Topics in Biostatistics 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

BSTA 160 Biostatistics Study Abroad 1-3 Credits
Biostatistics focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

BSTA 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

BSTA 308 Advanced R Programming 3 Credits
R language syntax and structure. R programming techniques. Emphasis on structured design for medium to large programs. R package development fundamentals. Capstone development project.
Prerequisites: BSTA 101 and BSTA 103

BSTA 309 Outbreak Science & Public Health Forecasting 3 Credits
This course aims to introduce students to models that describe the spread of a pathogen through a population, and how models can support public health decisions. The course will be split into four parts: (i) the factors that motivate public health actions, (ii) epidemic models such as the Reed-Frost and SIR, (iii) statistical time series and forecasts, (ii) a focus on ensemble building. Students will be expected to complete mathematical/statistical exercises and write code that simulates infectious processes.
Prerequisites: BSTA 101 and BSTA 103

BSTA 310 (CSE 310) Assistive Technologies 3 Credits
This class will introduce typical challenges faced by persons with disabilities and the role of assistive technologies (ATs) in solving such challenges. The class will examine opportunities presented by recent advances in mobile and AI technologies. Working in groups, each student will be expected to acquire and apply relevant skills in designing AT solutions. The class can be taken by students with diverse backgrounds including the following: community and population health, social and behavioral sciences, business, engineering and computer science.
Prerequisites: CSE 017 or (BSTA 101 and BSTA 102)

BSTA 320 (CGH 320, EPI 320, POPH 320) Independent Study or Research in Biostatistics 1-4 Credits
This course can be directed readings or research in Biostatistics or an experiential learning experience that puts student's understanding of Biostatistics into practice. Department permission required.
Repeat Status: Course may be repeated.

BSTA 330 Internship 1-4 Credits
In this advanced course, students will engage in supervised work in Biostatistics. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

BSTA 350 Special Topics in Biostatistics 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

BSTA 360 Biostatistics Study Abroad 1-3 Credits
Upper-level biostatistics focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

BSTA 372 Analyzing Electronic Health Record Data 3 Credits
This course will explain the structure and provide computing skills to analyze Electronic Health Record (EHR) data. Through a series of health-related case studies, students will have the opportunity to experience EHR as a comprehensive platform to support best-in-class evidence-based care and as the core component for big data analytics to help care organizations adapt and transform into learning organizations. The course will present a number of EHR data architectures, data standards, quality assessment, and workflow methods.
Prerequisites: BSTA 142

BSTA 373 Analyzing Clinical Natural Language Data 3 Credits
This course will convey specialized clinical natural language processing (NLP) principles and methods, as well as how to write regular expressions and parse and collate information from text-rich health documents such as electronic health records, clinical notes, and peer-reviewed medical literature. The course will engage real-world data sets for students to develop text-processing strategies. Computing will be a significant component of the course, ensuring students acquire the skills necessary to work with clinical natural language data.
Prerequisites: BSTA 142

BSTA 374 Analyzing Health GIS Data 3 Credits
This course will convey specialized methodologies of data collection and the statistical analysis of spatial data. Through a series of health-related case studies, students will have the opportunity to explore spatial statistical analysis at a variety of spatial resolutions. Computing will be a significant component of the course, ensuring that students acquire the skills necessary to apply these techniques to health-related GIS data.
Prerequisites: BSTA 142

BSTA 375 Analyzing Health Sensor Data 3 Credits
This course will convey specialized methodologies of data collection and the statistical analysis of health-related time-series data collected from sensors. Of particular interest are data generated by environmental sensors, wearable devices, and medical instrumentation. Through a series of health-related case studies, students will have the opportunity to explore signal processing, filtering, modeling, and forecasting techniques. Computing will be a significant component of the course, ensuring that students acquire the skills necessary to apply these techniques to health-related sensor data.
Prerequisites: BSTA 142

BSTA 376 Deep Learning for Healthcare 3 Credits
This course will convey the specialized methods of deep learning in the context of health data. Through health-related case studies, students will learn to engage deep learning models and healthcare applications such as clinical predictive models, computational phenotyping, patient risk stratification, treatment recommendation, and medical imaging analysis. The course will engage with real-world data sets via computing using Jupyter and PyTorch, ensuring that students acquire the skills necessary to apply deep learning techniques to health data.
Prerequisites: BSTA 142

BSTA 381 Analysis of Dependent Data 3 Credits
This course will convey specialized methodologies needed to analyze and model dependent data. By considering dependent data from a series of health-related case studies, students will have the opportunity to explore different types of statistical association, random effects models, generalized estimating equations, copula models, and nonparametric methods for dependent data. Computing will be a significant component of the course, ensuring that students acquire the skills necessary to carry out a wide range of analyses of health-related dependent data.
Prerequisites: BSTA 133

BSTA 383 Survival Analysis 3 Credits
This course will present methodologies needed to model time-to-event data. By considering censored (i.e., incomplete) health data from a series of case studies, students will explore nonparametric estimation (e.g., life table methods, Kaplan–Meier estimator), nonparametric methods for comparing the survival experience of populations, and semiparametric and parametric methods of regression for censored outcome data. Computing will be a significant component of the course, ensuring students acquire the skills necessary to conduct time-to-event analyses of health-related data.
Prerequisites: BSTA 133

BSTA 384 Network Analysis 3 Credits
This course will convey specialized methodologies needed to analyze and model network data. By considering relational data from a series of health-related case studies, students will have the opportunity to explore mathematical description of networks, social network measures, exponential random graph models of networks, network sampling, and visualization. Computing will be a significant component of the course, ensuring that students acquire the skills necessary to carry out a wide range of network-based analyses of health-related data.
Prerequisites: BSTA 133

BSTA 386 Bayesian Analysis 3 Credits
This course will provide a basic introduction to Bayesian concepts and methods with an emphasis on the data analysis in the context of health. We will discuss model choice, including the assessment of prior distributions. We will discuss how to conduct inference in a Bayesian setting, through posterior means, credible intervals and hypothesis testing. The Analyses will be performed using the freely available software Jags as implemented in the R packages rjags and R2jags.
Prerequisites: BSTA 133

BSTA 387 Analyzing Data in SAS 3 Credits
This course will introduce the student to the SAS programming language in a lab-based format. The objective is for the student to develop programming and statistical computing skills to address data management and analysis issues using SAS. The course will also provide a survey of some of the most common data analysis tools in use today and provide decision-making strategies in selecting the appropriate methods for extracting information from data.
Prerequisites: BSTA 133

BSTA 396 1-4 Credits
Repeat Status: Course may be repeated.

BSTA 399 Portfolio Project 1 Credit
This course will must be taken concurrently with an elective in either the Data or Methods clusters of the program. Students must inform the instructor for the associated elective about their registration in the Portfolio Project course. Portfolio Project students may be assigned additional material/assignments, and will be required to complete a significant report in the associated elective course.

BSTA 402 Biostatistics in Health 3 Credits
This course provides an introduction to the use of statistics in health. Topics include descriptive statistics, probability distributions, parameter estimation, hypothesis testing, analysis of contingency tables, analysis of variance, regression models, and sample size and power considerations. Students develop the skills necessary to perform, present, and interpret statistical analyses; and attain autonomy in handling real-world data using a statistical computing environment.

BSTA 403 Health Applications in Statistical Learning 3 Credits
This course will explore common statistical models used to analyze both continuous, discrete, and time to event data: simple and multivariate linear regression, logistic regression, poisson and negative binomial regression, and survival models. An emphasis will be placed on supervised learning. Throughout the semester, students will apply the theoretical background they learn in class to population health data sets, generating their own hypotheses and testing them with rigorous statistical methods.
Prerequisites: BSTA 402

BSTA 404 Data Architecture, Mining, and Linkage 3 Credits
This course will focus on collecting, storing, and formatting data for use in population health data analysis. Students will learn fundamental concepts and best practices for working with data, how to use Python to scrape the internet for data related to population health and learn how to link a diverse set of data together to test novel hypotheses students themselves pose during class.

BSTA 409 Outbreak Science & Public Health Forecasting 3 Credits
This course aims to introduce students to models that describe the spread of a pathogen through a population, and how models can support public health decisions. The course will be split into four parts: (i) the factors that motivate public health actions, (ii) epidemic models such as the Reed-Frost and SIR, (iii) statistical time series and forecasts, (ii) a focus on ensemble building. Students will be expected to complete mathematical/statistical exercises and write code that simulates infectious processes.

BSTA 410 (CSE 410) Assistive Technologies 3 Credits
This class will introduce typical challenges faced by persons with disabilities and the role of assistive technologies (ATs) in solving such challenges. The class will examine opportunities presented by recent advances in mobile and AI technologies. Working in groups, each student will be expected to acquire and apply relevant skills in designing AT solutions. The class can be taken by students with diverse backgrounds including the following: community and population health, social and behavioral sciences, business, engineering and computer science.

BSTA 420 (CGH 420, POPH 420, PUBH 420) Independent Study or Research in Biostatistics 1-4 Credits
This course can be directed readings or research in Biostatistics or an experiential learning experience that puts student's understanding of Biostatistics into practice. Department permission required.
Repeat Status: Course may be repeated.

BSTA 450 Special Topics in Biostatistics 3 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

Community and Global Health Courses

CGH 001 Community Health 3 Credits
The interdisciplinary field of community health focuses on improving the health of communities through health promotion and disease prevention, education, policy development, and community empowerment. This course provides students with an overview of theoretical, methodological, and practical aspects of community health with a focus on working in diverse communities. Students will gain an understanding of how community-level health issues relate to broader contextual issues within the community and externally.

CGH 002 Introduction to LGBTQ2+ Health 3 Credits
This course introduces students to the health of lesbian, gay, bisexual, transgender, queer/questioning, and and two-spirited (LGBTQ2+) populations in the United States and globally. Using an interdisciplinary approach, the course focuses on determinants of health, LGBTQ2+ health disparities, the history of LGBTQ2+ health, and major health issues faced by LGBTQ2+ people across the lifespan. Students explore individual, interpersonal, organizational, community, and policy influences on LGBTQ2+ health, as well as LGBTQ2+ affirming health policies, programs, and services.
Repeat Status: Course may be repeated.
Prerequisites: CGH 001 or POPH 001
Can be taken Concurrently: CGH 001, POPH 001
Attribute/Distribution: DEIN

CGH 004 Introduction to Global Health 3 Credits
In this course, students will receive an introduction to global population health. We begin with an analysis of the rise of the international community in addressing population health needs, and the international norms guiding healthcare delivery systems. We will also focus on healthcare delivery systems, innovations, and policy reforms in response to healthcare needs in several developing nations. Finally, students will understand the political, social, and more recent commercial determinants of population health in these countries.

CGH 007 Seven Dimensions of Health & Wellness 0,3 Credits
Much has been discussed in the public sphere about happiness and how an individual can achieve peak happiness. This course delves more holistically into health and wellness, moving beyond individual happiness and towards a multi-level understanding of how interactions with others and the environment impact the self. Using a multi-disciplinary approach, students will learn the seven dimensions of health and wellness, including physical, mental, emotional, spiritual, cultural, environmental, and community, and how they interact to create healthy people and communities.

CGH 016 Seminar: Cultural Understanding and Health 1 Credit
This course will introduce students to the basic perspectives and skills needed to work with peoples and communities other than their own in a cross-cultural setting. An introductory understanding of culture and the components of culture, such as values, beliefs, language, and world view, will be explored specifically in relation to health and health outcomes at the individual and community-levels.

CGH 021 Culture and Health 3 Credits
This course will introduce students to the complex and dynamic relationship between culture and health in Western and non-Western populations, communities, and societies. Cross-cultural institutions such as economics, politics, kinship, religion, and language, and their roles in sickness and illness will be discussed. The relationship between traditional and modern healing systems will also be analyzed.

CGH 022 Global Perspectives on Health 3 Credits
This course is designed to introduce students to the inequalities and systems of stratification various industrialized and non-industrialized peoples and cultures around the world face when it comes to their health and wellness. Critical theoretical perspectives will be utilized, as will case studies of health inequities and inequalities, to examine connections between health and cultural and social factors such as race, ethnicity, socio-economic status, and gender. Current global trends in addressing these inequities and inequalities will also be explored.

CGH 101 Careers in Community and Global Health Studies 3 Credits
In this interdisciplinary seminar, students will be exposed to individuals working in community and global health in academic positions, government and non-governmental organizations, community-based organizations, medical establishments, industry, and more. Through the eyes of these professionals, students will learn of career opportunities in these growing fields of study and will begin to chart their own career paths.

CGH 102 (CEE 102) Community Health and Engineering 3 Credits
This course is an introduction to public health engineering. Students will learn to define hazards and risks to community health such as air pollution; water, sanitation, and hygiene; food; and settlement/safety. The focus of the course will be on understanding engineering controls to reduce risk and improve communicable and non-communicable disease outcomes. This course includes elements of waterborne disease control, hazardous materials management, occupational health and safety, and environmental interventions.

CGH 103 Biological & Environmental Determinants of Health 4 Credits
This course provides students with a foundational knowledge of the biological mechanisms underlying health and disease. Students will learn about the evolutionary genetic basis of disease and the major disease transitions throughout history, all driven by interactions between the genetic composition of individuals and groups and their natural and built environment. Students will become familiar with the various infectious agents causing disease and the human immune response, as well as the biological determinants of chronic diseases. Not for biology majors.

CGH 104 Sociocultural & Political Determinants of Health 4 Credits
This course will look at cultural, social, and political institutions, as well as other components of culture, society, and social structure, that affect health and the health outcomes at the individual and community-levels. Topics to be analyzed include cultural traditions, social norms, politics, laws and policies, economics, housing, transportation, and subsistence strategies, just to name a few. Additionally, specific illnesses, sicknesses, and diseases linked to cultural, social, and political institutions in the human experience will be explored.

CGH 105 Commercial Determinants of Health 4 Credits
In this course, students will learn about the role that major soda and ultra-processed food industries play in affecting public health outcomes and policy-making processes. Carefully examining the cases of the United States and developing nations, this course reveals how and why these industries influence consumption patterns in different communities, how government, civil society, and the international community is responding, and the various strategies used by industry to influence policy decisions in their favor.

CGH 106 Qualitative Methods in Health Research 3 Credits
This course is designed to give students a basic understanding of qualitative data collection and analysis methods used in community and global health research. Students will learn about data collection using participation and observation, interviews, and focus groups. Students will also learn about text analysis and presenting qualitative results. This course is not designed to provide an in-depth examination of these methods or practical experience, but rather an introduction to their uses and how they complement quantitative methods.

CGH 107 What is the US Healthcare Ecosystem? 3 Credits
This course examines the structure, functioning, financing, and performance of the U.S. healthcare system. It aims to provide a general overview of the relationships between healthcare consumers, providers, organizations, payers, and regulators. The course will cover the history of the U.S. healthcare system and the political and social environment in which it exists and compare it to systems from other countries.

CGH 108 Food Justice 3 Credits
This course examines community and population health nutrition through the lens of social and environmental justice to examine the cultural, political, and social contexts of food in the United States. Students will engage with case studies, personal experiences with food, guest speakers, and debates on critical policy issues in nutrition and food access. This course will help students to understand the complex relationship between food systems and health and offers insight into practices and movements for sustainability, sovereignty, and equity.
Prerequisites: CGH 001

CGH 109 Introduction to Health Education 3 Credits
This course introduces the major theories and models of health education at multiple levels (individual, interpersonal, organizational, community, and public policy). Particular focus will be put on the introduction, analysis, and application of health behavior theories to health promotion and education practice. The theories to be discussed will provide students with frameworks for understanding health behavior change and designing effective health education programs and interventions.
Prerequisites: CGH 001

CGH 110 Coaching Towards Joy, Meaning, and Social Change 4 Credits
In this course you will learn and practice professional coaching techniques as one way to create meaning, increase your well-being, move towards what you want to achieve and who you want to be. You will learn to coach within and across your different identities/positionalities and consider how this self-work contributes to social change and challenges oppression. The course is well-suited for students interested in peer advising, activism, mentoring and leadership in any area.

CGH 120 (BSTA 120, EPI 120, POPH 120) Independent Study or Research in Community and Global Health 1-4 Credits
This course can be directed readings or research in Community and Global Health or an experiential learning experience that puts the student's understanding of Community and Global Health into practice. Topics addressed will be at an intermediate level. Department permission required.
Repeat Status: Course may be repeated.

CGH 122 Indigenous Healing Traditions 3 Credits
In this course, students will be introduced to the healing traditions of the Indigenous peoples of the Americas. Special attention will be paid to the Native peoples and nations of the United States. Traditional Indigenous perspectives of wellness and unwellness will be explored, as well as healing rites, rituals and ceremonies from Pre-Contact times to the present-day. Indigenous health and healing in the context of colonization and the introduction of Old World diseases will also be discussed.

CGH 130 Internship in Community and Global Health 1-4 Credits
In this introductory course, students will engage in supervised work in Community and Global Health. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations and the private sector. A written report is required and preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

CGH 150 Special Topics in Community and Global Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

CGH 151 Special Topics in Indigenous Peoples Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

CGH 160 Community & Global Health Study Abroad 1-3 Credits
Community and Global Health focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

CGH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

CGH 301 Community and Global Health Field Experience I 1-3 Credits
With the assistance of their advisor, students identify a community internship or field experience site domestically or internationally and write a proposal for the experience and accompanying deliverable and capstone report. The deliverable should be an artifact (e.g., health promotion materials, website, presentation of data, etc.) that the student provides to the site and is agreed upon by the student, advisor, and internship site. A capstone report documents the experience, which should align with the student's concentration and career plans.
Repeat Status: Course may be repeated.

CGH 302 Community & Global Health Field Experience II 1-3 Credits
In this course, students will implement their field experience, including deliverable and capstone report, proposed in CGH 301. The deliverable will be presented to the field site in both written and oral form. The capstone report will be submitted to the student's advisor and will be accompanied by an oral presentation to CGH students and faculty. A field site preceptor evaluation will be required. This course must be taken concurrently with or after CGH 301.
Repeat Status: Course may be repeated.
Prerequisites: CGH 301
Can be taken Concurrently: CGH 301

CGH 303 Honors Community and Global Health Field Experience I 1-4 Credits
Students identify a community internship or field experience site domestically or internationally, write a proposal for the experience and accompanying deliverable and capstone report. Deliverable is an artifact (e.g., health promotion materials, website, presentation of data, etc.) that the student provides and is agreed upon by the student, advisor, and site. The capstone report documents the experience. This course includes a weekly honors seminar, minimum major GPA 3.5 required. Students are required to complete 4 credits of this course.
Repeat Status: Course may be repeated.

CGH 304 Honors Community and Global Health Field Experience II 1-4 Credits
Students implement their field experience, including deliverable and capstone report, proposed in CGH 303. The deliverable is presented to the field site in both written and oral form. The capstone report is submitted to the student's advisor and accompanied by an oral presentation to CGH students and faculty. A field site preceptor evaluation is required. This course includes a weekly honors seminar, minimum GPA 3.5 in major required. Students are required to complete 4 credits of this course.
Repeat Status: Course may be repeated.
Prerequisites: CGH 303
Can be taken Concurrently: CGH 303

CGH 305 Advanced Qualitative Methods in Community and Global Health 3 Credits
This course, designed to be taken after Introductory Methods in Community and Global Health, focuses on the practical application of qualitative data collection and analysis techniques learned in the introductory course in qualitative methods within the context of applied health research. Students will design and conduct a qualitative health study. Students will also be exposed to advanced techniques in qualitative research, such as ethnography, visual methods, computer-assisted analysis, and more.
Prerequisites: CGH 106

CGH 306 Mixed Methods in Health Research 3 Credits
Students in this course will be introduced to ways in which qualitative and quantitative data can be integrated to capture a broader perspective and answer more complex research questions than either will provide alone. The course will cover formulating mixed methods research questions, collecting and analyzing different types of data, analysis across multiple mixed data sets, choosing appropriate mixed methods designed for both qualitatively- and quantitatively-driven studies, and interpreting mixed methods results.
Prerequisites: CGH 106 and BSTA 001

CGH 307 Health Survey Research Methods 3 Credits
In this course, students will explore and apply the foundational concepts and methods related to survey design and implementation. Students will be introduced to such concepts as sampling theory, question design and ordering, methods of survey data collection, bias and error in survey research, measure development and validation, and data preparation for analysis. Students will be exposed to several national health surveys, as well as surveys designed for smaller scale use.
Prerequisites: POPH 001 or CGH 001

CGH 308 Community Health Intervention Design 3 Credits
This course is designed to introduce students to development, implementation, and evaluation of health-related programs and interventions in community settings. Students will learn the theoretical foundations of intervention design and will examine evidence-based programs from multiple fields of study. Students will be introduced to aspects of intervention design such as cultural appropriateness, individual tailoring, health literacy issues, sustainability, and more.
Prerequisites: POPH 001 or CGH 01

CGH 309 Ethnomedical Traditions of the Americas 3 Credits
This course will introduce students to the rich and diverse ethnomedical traditions of various peoples and cultures in North, Central, and South America and the Caribbean. Indigenous, African-Diasporic, European, and Asian ethnomedical traditions will be discussed. The manners in which these ethnomedical systems diagnose and treat individuals will be explored, as well as the ways they compare to mainstream allopathic medicine. Topics commonly associated with ethnomedicine, such as herbalism, ritualized healing, and altered states of consciousness, will also be investigated.

CGH 310 Rural Communities and Health in the United States 3 Credits
This course is designed to allow students to examine health at the individual and community levels in rural America. Special attention will be paid to individuals and communities that engage in economic activities connected to rural America – ranching, farming, and natural resource extraction. In addition, populations who reside primarily in rural areas, both mainstream and non-mainstream, will be investigated. The health problems, health outcomes, access to health care, and alternative treatments will be explored.

CGH 311 Religion, Spirituality, and Health 3 Credits
This course will examine the complex and dynamic relationships among religion, spirituality, and health. Religion's and spirituality's roles in health promotion and disease prevention will be explored at the individual and community-levels. Social science and biomedical perspectives will be utilized to understand these relationships, as well as the perspectives of practitioners from numerous Western and Non-Western religious and spiritual traditions.
Prerequisites: POPH 001 or CGH 001

CGH 312 Curses, Possessions, and Supernatural Illnesses 3 Credits
In this course students will utilize a community health perspective to investigate the causes, symptoms, and treatments, as well as the roles, supernatural illnesses play in Western and Non-Western communities around the world. Supernatural illnesses associated with curses, hexes, ghosts, malevolent entities, and the spirit world will be examined. The cultural, social, economic, political, and legal effects these illnesses have on afflicted individuals, their families, and the communities in which they live will also be explored.
Prerequisites: POPH 001 or CGH 001

CGH 313 Health Policy and Politics 3 Credits
In this course, students learn the various methods as well as conceptual and analytical frameworks involved in the policy-making and the political processes involved. Issues of policy agenda-setting, policy diffusion, policy formulation, and implementation will be addressed, ultimately going through the 'entire' policy-making process. Concepts and methods in political science will be introduced as well as their application to health policy-making. This module will close with several case study illustrates from the United States and around the world.

CGH 314 Advanced Commercial Determinants of Health 3 Credits
In this upper-level course, students will learn the roles that major soda, food, tobacco, entertainment, and pharmaceutical industries play in affecting population health. This course reveals how and why these industries influence consumption, mental health, and social interactions within communities; how government, civil society, and the international community is responding; and industry's strategic response. This course is reading and writing intensive and employs comparative qualitative case study methods and analysis.
Prerequisites: CGH 105

CGH 315 Medical Mysteries 3 Credits
Everything is a mystery until it is solved, including in medicine. This course begins with an exploration of historical medical mysteries and discussion of what happened after they were solved as a foundation for understanding the present. Students will then learn what differential diagnosis is and what happens when it leaves you with nothing. The course culminates in an examination of a series of current medical mystery case studies in the realms of physical, mental, and spiritual health.
Prerequisites: CGH 103

CGH 316 Global Environmental Disasters & Policy 3 Credits
Disasters can leave individuals, communities, and nations reeling to pick up the pieces. This course will look at case studies of major global disasters, including those created by people and nature, and the global magnitude of these disasters. Students will analyze disaster preparedness policies enacted in response to these disasters and learn about the inequalities that disproportionately impact marginalized communities in the aftermath.
Prerequisites: CGH 103 and (POPH 001 or CGH 001)

CGH 317 Sex, Drugs, and Trauma 3 Credits
This course will explore health issues existing at the intersection of mental and sexual health. The course will focus on overlapping experiences of sex, sexuality, drug use, and both individual and structural violence. Applying a social justice lens, we will examine health inequities within these intersections as well as strategies to ameliorate inequities and to help heal individuals and communities. Students will be introduced to trauma-informed approaches, advocacy efforts, and the role of storytelling and the arts.
Prerequisites: CGH 104

CGH 318 Sexuality Education 3 Credits
This course explores issues and controversies surrounding the provision of school-based sexuality education in the United States. Students critically review evidence-based programs, professional guidelines, federal and state policies, as well as political and community forces that impact classroom instruction. Students also learn, through interactive activities and classroom discussion, how to design age-appropriate, medically accurate, trauma-informed, sex-positive, LGBTQ+ inclusive, and culturally responsive sexuality education programs.
Prerequisites: CGH 001 or POPH 001

CGH 319 Public Health Law 3 Credits
This course will explore the legal principles of public health. It will cover laws currently on the books and implementation problems in the highly politicized and culturally sensitive context of health and behavior. Topics include the public health powers, duties, and limitations of authorities and the epidemiological influence of law on health and health behavior. It will also cover how health is socially constructed and how legal responses to health and wellbeing complicate efforts to promote public health.
Prerequisites: CGH 104

CGH 320 (BSTA 320, EPI 320, POPH 320) Independent Study or Research in Community and Global Health 1-4 Credits
This course can be directed readings or research in Community and Global Health or experiential learning that puts the student's understanding of Community and Global Health into practice. Topics addressed will be at an advanced level. Department permission required.
Repeat Status: Course may be repeated.

CGH 322 Contemporary Indigenous Health 3 Credits
In this course, students will learn about the health issues Indigenous peoples of the Americas and their communities presently face. Prevalent diseases will be explored, as well as social, economic, and political issues affecting access to treatment and care. Historical and contemporary laws and policies affecting Indigenous health will also be analyzed. Additionally, Indigenous responses to contemporary health concerns will be explored including decolonization, food sovereignty, and cultural reclamation.

CGH 330 Internship in Community and Global Health 1-4 Credits
In this advanced course, students will engage in supervised work in Community and Global Health. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required and preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

CGH 331 Healthcare Finance 3 Credits
This foundation course will introduce students to the key financial management principles, concepts and techniques as applied to health services organizations. This course will cover financial analysis and reporting, revenue sources and reimbursement methods, working capital management, revenue cycle management, and capital budgeting techniques used in the healthcare industry.
Prerequisites: CGH 001 or POPH 001

CGH 332 Aging, Health, and Social Policy 3 Credits
This course describes and evaluates the health and social policy consequences of population aging in the U.S. and abroad. The course begins with an exploration of global trends in aging, longevity, and health. Next, we examine cross-national responses to population aging with case studies from higher, middle, and lower income countries.
Prerequisites: CGH 001 or POPH 001

CGH 334 Cross-National Comparisons of Health Systems & Policy 3 Credits
Countries around the world face a range of common problems in their public health and health care systems. These include demographic and technological changes, budget pressures. and inequalities in health and access to health care services. Policy responses to these common challenges. We will examine the health policy responses of higher and lower income nations and seek to explain why nations differ in their policy choices while exploring the pros and cons of these approaches.
Prerequisites: CGH 001 or POPH 001

CGH 335 Healthcare Operations Management 3 Credits
This course examines opportunities for operational improvement in healthcare organizations. It offers a broad survey of the concepts, techniques, and tools involved in designing and managing efficient and effective processes in healthcare settings. Topics covered include balanced scorecard, project management, decision analysis, performance improvement, capacity management, and inventory management.
Prerequisites: CGH 001 or POPH 001

CGH 350 Special Topics in Community and Global Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

CGH 351 Special Topics in Indigenous Peoples Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

CGH 375 (EDUC 375, HMS 375) Community Based Participatory Research Methodology 3-4 Credits
The course provides an introduction to the core concepts of community based participatory research (CBPR) methodology applied to social science research to address public health issues. The course will equip students with strategies for developing community academic partnerships as well as to strengthen skills in research methods.
Attribute/Distribution: SS

CGH 414 Advanced Commercial Determinants of Health 3 Credits
In this upper-level course, students will learn the roles that major soda, food, tobacco, entertainment, and pharmaceutical industries play in affecting population health. This course reveals how and why these industries influence consumption, mental health, and social interactions within communities; how government, civil society, and the international community is responding; and industry's strategic response. This course is reading and writing intensive and employs comparative qualitative case study methods and analysis.
Prerequisites: CGH 105

CGH 418 3 Credits
This course explores issues and controversies surrounding the provision of school-based sexuality education in the United States. Students critically review evidence-based programs, professional guidelines, federal and state policies, as well as political and community forces that impact classroom instruction. Students also learn, through interactive activities and classroom discussion, how to design age-appropriate, medically accurate, trauma-informed, sex-positive, LGBTQ+ inclusive, and culturally responsive sexuality education programs.

CGH 420 (BSTA 420, POPH 420, PUBH 420) Independent Study or Research in Community and Global Health 1-3 Credits
This course can be directed readings or research in Community and Global Health or experiential learning that puts the student's understanding of Community and Global Health into practice. Topics addressed will be at an advanced level. Department permission required.
Repeat Status: Course may be repeated.

CGH 430 Internship in Community and Global Health 1-3 Credits
In this advanced course, students will engage in supervised work in Community and Global Health. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required and preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

CGH 431 Healthcare Finance 3 Credits
This foundation course will introduce students to the key financial management principles, concepts and techniques as applied to health services organizations. This course will cover financial analysis and reporting, revenue sources and reimbursement methods, working capital management, revenue cycle management, and capital budgeting techniques used in the healthcare industry.

CGH 435 Healthcare Operations Management 3 Credits
This course examines opportunities for operational improvement in healthcare organizations. It offers a broad survey of the concepts, techniques, and tools involved in designing and managing efficient and effective processes in healthcare settings. Topics covered include balanced scorecard, project management, decision analysis, performance improvement, capacity management, and inventory management.

CGH 450 Special Topics in Community and Global Health 3 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

CGH 497 1-3 Credits
Repeat Status: Course may be repeated.

Epidemiology Courses

EPI 104 Fundamentals of Epidemiology 3 Credits
Introduces epidemiology and its application in public health. Addresses basic epidemiologic terminology and definitions. Presents public health problems in terms of magnitude, person, time, place, and disease frequency. Examines correlation measures between risk factors and disease outcomes; strengths and weaknesses of standard epidemiologic study designs; and ethical and legal issues related to epidemiologic data. Students calculate basic epidemiology measures, draw inferences from epidemiologic reports, and use information technology to access, evaluate, and interpret public health data.
Prerequisites: POPH 002

EPI 120 (BSTA 120, CGH 120, POPH 120) Independent Study or Research 1-4 Credits
This course can be directed readings or research in Epidemiology or an experiential learning experience that puts students' understanding of Epidemiology into practice. Department permission is required.
Repeat Status: Course may be repeated.

EPI 130 Internship 1-4 Credits
In this introductory course, students will engage in supervised work in Epidemiology. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

EPI 150 Special Topics in Epidemiology 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

EPI 160 Epidemiology Study Abroad 1-3 Credits
Epidemiology focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

EPI 300 Apprentice Teaching 1-4 Credits
Instructor permission required.
Repeat Status: Course may be repeated.

EPI 305 Intermediate Epidemiology 3 Credits
This course offers a deeper, expanded view of concepts and methods for observational epidemiological studies. Experiential learning activities and data collection give students opportunities to apply concepts learned in EPI 104. Topics include environmental, molecular, and genetic epidemiology, descriptive methods, analytic study designs (ecologic, cross-sectional, cohort, and case-control studies), confounding, and effect modification. Includes the use of multivariable models to adjust for confounding effects. Deeper concepts in causal inference are examined through the use of directed acyclic graphs.
Prerequisites: EPI 104 and (BSTA 133 or (BSTA 103 and BSTA 104),)

EPI 306 Lifecourse Epidemiology 3 Credits
This course provides students a foundation for understanding the terminology and theoretical framework used in life course epidemiology and family health services research; biobehavioral pathways by which early life experiences impact health across the life course; data sources, study designs, and statistical approaches used in lifecourse epidemiology and family health services research; and implications for clinical and public health practice, policy, and health system development with an eye towards development of effective and sustainable life course interventions.
Prerequisites: POPH 001

EPI 308 Spatial Epidemiology 3 Credits
This course will provide students with an introduction to Geographic Information Systems (GIS) and its application in population health. It is primarily intended for students in Population Health, but students from other programs will also get good exposure to the capabilities of GIS in health science. The course is designed to teach a mix of practical skills and fundamental concepts. The first half focuses on basic skills and concepts, while the second half focuses on using GIS for analysis.
Prerequisites: EPI 304

EPI 309 Chronic Disease Epidemiology 3 Credits
This course explores the epidemiology of common chronic diseases, including cardiovascular, cancer, metabolic, musculoskeletal, neurologic and others. Major risk factors include tobacco use, diet and nutrition, physical inactivity, and alcohol use. For each chronic disease we will review the significance of the chronic disease by describing the health disparities across various demographic groups as well as discuss the major risk factors attributed to the disease. Finally, students will critique evidence-based interventions from the published literature.
Prerequisites: EPI 104

EPI 310 Environmental Epidemiology & Exposure Science 3 Credits
Environmental epidemiology examines the associations of diseases with occupational exposures and other environmental risk factors. Exposure science is the study of contact between humans and environmental risk factors, and it plays a fundamental role in the development and application of epidemiology, toxicology, and risk assessment. This course aims to engage students to understand the relationship between environmental exposure and human health, learn how to conduct exposure assessments, and know the application to promote and protect human health.
Prerequisites: EPI 304

EPI 311 Psychiatric Epidemiology and Global Mental Health 3 Credits
This course examines global mental health through the lens of psychiatric epidemiology and cultural psychiatry. It utilizes a life course framework to understand the bio-psycho-social determinants of mental health and global burden of mental disorders throughout the lifespan. Students will explore mental health and illness with an emphasis on culture, diversity, and social inclusion. Focus is placed on exploring diverse cultural conceptualizations and presentations of mental health and illness and implementing culturally appropriate prevention and intervention programs.
Prerequisites: EPI 104

EPI 320 (BSTA 320, CGH 320, POPH 320) Independent Study or Research 1-4 Credits
This course can be directed readings or research in Epidemiology or an experiential learning experience that puts students' understanding of Epidemiology into practice. Department permission is required.
Repeat Status: Course may be repeated.

EPI 330 Internship 1-4 Credits
In this advanced course, students will engage in supervised work in Epidemiology. Placements will be arranged to suit individual interests and career goals. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required, and a preceptor evaluation will be required. Department permission is required.
Repeat Status: Course may be repeated.

EPI 350 Special Topics in Epidemiology 3-4 Credits
In this course, students will explore the substantive and methodological concepts related to a specific Epidemiology content area. Examples may include Lifecourse Epidemiology, Molecular Epidemiology, and Infectious Disease Epidemiology.
Repeat Status: Course may be repeated.

EPI 360 Epidemiology Study Abroad 1-3 Credits
Upper-level epidemiology-focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

EPI 404 Methods in Epidemiology I 3 Credits
This course addresses advanced epidemiologic terminology and definitions. Presents public health problems in terms of magnitude, person, time, place, and disease frequency. Examines and critiques correlation measures between risk factors and disease outcomes; strengths and weaknesses of standard epidemiologic study designs; and ethical and legal issues related to epidemiologic data. Students calculate basic epidemiology measures (rates, Odds Ratios, Relative Risks, and others), draw inferences from epidemiologic reports, and use information technology to access, evaluate, and interpret public health data.

EPI 405 Methods in Epidemiology II 3 Credits
This course investigates complicated questions in epidemiology providing a deeper, expanded view of concepts and methods for observational epidemiological studies. Through experiential learning and data collection, students apply concepts learned in EPI 404, analyze primary data, write epidemiological reports. Topics include confounding, effect modification, cohort studies, case-control study variants, analytical methods. Students use multivariable models to model relationships between risk factors and health outcomes while adjusting for confounding effects. Deeper concepts in causal inference examined through directed acyclic graph use.
Prerequisites: EPI 404

EPI 411 Psychiatric Epidemiology and Global Mental Health 3 Credits
This course examines global mental health through the lens of psychiatric epidemiology and cultural psychiatry. It utilizes a life course framework to understand the bio-psycho-social determinants of mental health and global burden of mental disorders throughout the lifespan. Students will explore mental health and illness with an emphasis on culture, diversity, and social inclusion. Focus is placed on exploring diverse cultural conceptualizations and presentations of mental health and illness and implementing culturally appropriate prevention and intervention programs.

EPI 450 Special Topics in Epidemiology 3 Credits
In this course, students will engage in an intensive exploration of the substantive and methodological concepts related to a specific Epidemiology content area. Examples may include Lifecourse Epidemiology, Molecular Epidemiology, and Infectious Disease Epidemiology.
Repeat Status: Course may be repeated.

Health Innovation Technology Courses

HIT 010 Seminar: Design Thinking for Innovation in Health 1 Credit
Design Thinking is a human centered design process used to identify problems and create actionable solutions. Students will be exposed to the process, and attitudes needed, to frame and reframe problems, challenge assumptions, access their creativity, and tell compelling stories to communicate their ideas. The emphasis is on learning by doing and focuses on practicing the 5 steps in Design Thinking: Empathize, Define, Ideate, Prototype, Test that can be applied to virtually any area where new solutions are needed.

Population Health Courses

POPH 001 Introduction to Population and Public Health 4 Credits
Despite significant advances in medicine and public health, inequities in health persist. Understanding health on a population level is an approach that seeks to improve the health of the whole population, unravel variations in health outcomes, and to identify effective strategies for reducing or eliminating inequities. The purpose of this course is to provide students with an understanding of: 1) how population and public health are defined and measured; and 2) the determinants of population health.

POPH 002 Population Health Research Methods & Application 4 Credits
This course provides students with fundamental principles of research methods relevant to population health and the translation of research into practice. Through this course, we will review a range of study designs, including experimental and observational studies, mixed methods, and comparative qualitative case study methods. In addition, students will obtain the skills needed to translate research into practice for multiple stakeholder groups.
Prerequisites: POPH 001

POPH 003 Justice, Equity, and Ethics in Population Health 3 Credits
The goal is to examine the historical and emerging issues in population health ethics. The course will introduce both the historical contexts and contemporary issues in population health dilemmas. Topics of interest include: 1) resource distribution and social justice; 2) self-sufficiency and paternalism; 3) health promotion & disease prevention; 4) patients' right to privacy; 5) research integrity; and 6) newly emerging issues. Students will debate, research, and propose solutions and intervention strategies through group discussions, role play, and presentations.

POPH 007 (BSTA 007) 3 Credits
This course presents a broad contemporary survey of the actual and potential contributions of Artificial Intelligence and Health Data Science in addressing public health challenges. By reading recent articles that describe case studies of AI in health and healthcare and by engaging in discussions both in class and online, students will come to appreciate the many unsolved problems in public health and how one may evaluate the potential benefits and risks of exciting new data-centric solutions made possible by AI.

POPH 010 Seminar: Population Health 1 Credit
This one-credit special topics seminar will focus on the development of Population Health relevant skills in the areas of communication, professional development, mentorship and leadership, proposal development, policy and advocacy and community engagement and coalitions.
Repeat Status: Course may be repeated.

POPH 012 Seminar: Ethics in Population Health 1 Credit
This seminar will introduce students to ethical concepts and critical issues pertaining to the ethical inclusion of human subjects in population health research. This course will provide opportunities for writing about, discussion of, and case-based learning around current and historical perspectives on population health research. During this course, students will complete the necessary training for conducting human subjects research at Lehigh University.

POPH 101 History of Population Health 3 Credits
This course introduces students to the development of population health as a convergent science. Students will learn about the evolution of population health interests, normative beliefs in service delivery, and policy at the international and domestic level. The principles, ethical values and services enforced by law will be learned. Students will explore the initiatives, collectively achieved among various sectors, addressing the determinants of health. We conclude by addressing future population health challenges, such as the environment, non-communicable diseases, and inequalities.

POPH 104 Careers in Population Health 3 Credits
In this interdisciplinary seminar, students will be exposed to individuals working in various disciplines with the field of population health in academic positions, government and non-governmental organizations, community-based organizations, medical establishments, industry, and more. Through the eyes of these professionals, students will learn of career opportunities in these growing fields of study and will begin to chart their own career paths.

POPH 105 Introduction to Maternal and Child Health 3 Credits
The course introduces the student to the Maternal and Child Health field. Students will examine the multi-dimensional determinants of maternal and child health issues using a Life Course approach. Students will also explore the roles of research, programs, policy, and advocacy in the reduction of maternal and child health disparities.

POPH 106 Global Environment and Human Welfare 3 Credits
This course investigates the present understanding of multiple pollution agents and their effects on human health and well-being. The students will examine the history, the emergence, the known risks from exposure to specific pollutants through multiple media (e.g. air, water, food) with a particular focus on air pollution. Through readings, discussions, and a project, students are expected to cultivate a critical understanding of the risks posed by environmental pollutants on human health and identify knowledge gaps.

POPH 107 Sleep and Physical Activity in Population Health 3 Credits
This course explores how physical activity (PA) and sleep impact population health. Students will evaluate the scientific literature on the role of PA and sleep in preventing chronic diseases, promoting mental health, and enhancing overall well-being. Through experiential research, students will also learn how to measure PA and sleep information. The course will examine how environmental, social, cultural, and policy-related factors influence PA and sleep behaviors in diverse populations.
Prerequisites: CGH 001

POPH 120 (BSTA 120, CGH 120, EPI 120) Independent Study or Research in Population Health 1-4 Credits
This course can be directed readings or research in Population Health or an experiential learning experience that puts students's understanding of Population Health into practice. Department permission required.
Repeat Status: Course may be repeated.

POPH 126 Population Health and the Media 3 Credits
This course explores the importance of the relationship that health organizations have with the media and the powerful role it can play in what a population deems important in public health. We will examine how mass media campaigns have been used to change behaviors: tobacco, alcohol and drug use; lowering risk factors for heart disease and diabetes; and even road safety to produce life-saving changes in large populations as well as to manage national and worldwide health crises.

POPH 130 Internship in Population Health 1-4 Credits
In this introductory course, students will engage in supervised work in Population Health. Potential internship sites include government agencies, non profit organizations and the private sector. A written report is required and preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

POPH 150 Special Topics in Population Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an intermediate level.
Repeat Status: Course may be repeated.

POPH 160 Population Health Study Abroad 1-3 Credits
Population health focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

POPH 195 1-4 Credits
Repeat Status: Course may be repeated.

POPH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

POPH 301 Population Health Capstone (Proposal) 1-3 Credits
In this writing intensive course, students will work closely with their academic advisor and site preceptor to develop a detailed proposal for a Population Health project. Department permission required. Students must complete 3 credits of Capstone Proposal.
Repeat Status: Course may be repeated.
Attribute/Distribution: WRIT

POPH 302 Population Health Capstone (Execution) 1-3 Credits
In this course, students will implement and evaluate the Population Health project proposed in POPH 301. A final capstone report, oral presentation, and preceptor evaluation will be required. Department permission required. Students must complete 3 credits of Capstone Execution.
Repeat Status: Course may be repeated.
Prerequisites: POPH 301

POPH 305 Honors Population Health Capstone (Proposal) 1-4 Credits
In this writing intensive course, students will work closely with their academic advisor and site preceptor to develop a detailed proposal for a Population Health project. This course includes a weekly honors seminar. To qualify for honors, students must have a 3.5 major GPA and department permission. A total of 4 credits is required to complete the Capstone Proposal.
Repeat Status: Course may be repeated.

POPH 306 Honors Population Health Capstone (Execution) 1-4 Credits
In this course, students will implement and evaluate the Population Health project proposed in POPH 305. A final capstone report, oral presentation, and preceptor evaluation will be required. This course includes a weekly honors seminar. To qualify for honors, students must have a 3.5 major GPA and department permission. A total of 4 credits is required to complete the Capstone Execution.
Repeat Status: Course may be repeated.
Prerequisites: POPH 305
Can be taken Concurrently: POPH 305

POPH 317 Urban Greenspace and Health 3 Credits
This class will investigate the myriad and complex ways in which urban greenspaces impact the health of human populations. This course will present biological/psychosocial theories and mechanisms as well as topical and methodological issues underlying relationships between greenspace and health. The class will also analyze contemporary urban greening interventions. Students will complete experiential learning activities to collect and analyze data describing health effects of urban greenspaces. Additional topics include chronic diseases, mental health, stress, climate change adaptation, urban heat islands.
Prerequisites: EPI 104

POPH 318 Advanced Technologies for Health 3 Credits
This course introduces different technologies related to healthcare, health education, and health promotion. We will explore how the technologies, including computer simulations, serious games, immersive environments (VR/AR), virtual agents, dashboards, eye tracking, emotion detection, and wearable sensors, can be used for health education and promotion. We also discuss the theoretical models and theories guiding the design/use of those technologies.
Prerequisites: POPH 001 or CGH 001

POPH 319 Population Health Bioethics 3 Credits
This course will focus on macro-level bioethical dilemmas that arise outside the clinic, at the level of the population, the state, the country, or the globe. Population health policies raise questions about autonomy, individual rights, coercion, justice, community, the meaning of the common good, norms of research, and multi-cultural values. The course will explore a range of questions, including: how to conceptualize, measure and evaluate health inequalities?; how should we set spending priorities?; is paternalism acceptable?
Prerequisites: POPH 001 or CGH 001

POPH 320 (BSTA 320, CGH 320, EPI 320) Independent Study or Research in Population Health 1-4 Credits
This course can be directed readings or research in Population Health or experiential learning that puts the student's understanding of Population Health into practice. Department permission required.
Repeat Status: Course may be repeated.

POPH 330 Internship in Population Health 1-4 Credits
In this advanced course, students will engage in supervised work in Population Health. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required and preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

POPH 350 Special Topics in Population Health 3-4 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

POPH 360 Population Health Study Abroad 1-3 Credits
Upper-level population health focused course taken during an abroad experience.
Repeat Status: Course may be repeated.

POPH 401 Population Health Concepts and Methods 3 Credits
In this introductory graduate course, students will apply foundational concepts related to the definition and measurement of health and disease as well as the multiple determinants of population health (from cell to society). Students will then apply the fundamental principles of quantitative and qualitative research methodologies in order to integrate the multiple determinants of health in population health research and practice. This course will also explore the translation of research findings to programmatic intervention and policy development.

POPH 403 Biological Basis of Population Health: Concepts and Methods 3 Credits
In this graduate course, students will investigate the biological mechanisms underlying population health outcomes as well as the roles of individual and group susceptibility to disease. Students will also explore and apply the emerging and traditional tools used in genomic, molecular, immunological, and environmental fields. Students will then integrate the biological and societal determinants of health in order to propose programmatic and policy interventions that promote health and prevent disease.

POPH 405 Qualitative Research Methods 3 Credits
This is a graduate-level course designed to teach the basics of rigorous qualitative methodology. It is a practical course through which you will learn about and gain experience in study design and sampling methods; data collection through participation and observation, interviews, and focus groups; different traditions of data analysis; and presenting qualitative methods in academic writing, including for study design or grant writing and academic journal writing.

POPH 406 Seminar: Cultural Understanding and Health 1 Credit
Cultural understanding and cultural relativism provide perspectives, abilities, and skills needed to work with diverse peoples and communities in cross-cultural settings. This course will explore cultural understanding and cultural relativism as well as other perspectives, methods, and skills required to understand, participate in, and implement culturally-appropriate and culturally-relevant health-related projects at the individual and community-levels.

POPH 407 Seminar: Data-informed Policy Making 1 Credit
This seminar will introduce students to the different ways in which data informs the policy decision-making process. We will begin with an analysis of the different types of data and how they influence policy prioritization processes. This will be followed by a discussion about how governments and non-governmental organizations strategically use data to evaluate policy effectiveness and search for improvements.

POPH 408 Population Health Survey Methods 3 Credits
In this graduate course, students will explore and apply the foundational concepts and methods related to questionnaire design, sampling, quantitative and qualitative data collection, and data preparation for analysis. Specifically, this course will expose students to the foundational concepts and skills related to measure development and validation. This course will also introduce students to mixed methods research.
Prerequisites: POPH 401 and (EPI 404 or EPI 304) and BSTA 402

POPH 409 Social Determinants of Health 3 Credits
This course will look at cultural and social institutions, as well as other components of culture, society, and social structure, that affect health and the health outcomes at the individual and community-levels. Topics to be analyzed include cultural traditions, social norms, politics, economics, housing, transportation, and subsistence strategies, just to name a few. Additionally, specific illnesses, sicknesses, and diseases linked to cultural and social institutions and the human experience will also be explored.
Prerequisites: POPH 401

POPH 410 Population Health Capstone/Thesis Project 3 Credits
In this writing-intensive course, students will work closely with their academic advisor to develop a detailed research proposal for a population health thesis project.
Prerequisites: POPH 401

POPH 411 Population Health Thesis II (execution) 3 Credits
In this course, students will work closely with their academic advisor and other relevant mentors to implement and evaluate the population health thesis project proposed in "Population Health Thesis I". A final thesis paper and oral presentation will be required.
Prerequisites: POPH 410

POPH 413 Foundations of Global Health 3 Credits
This graduate-level course provides an in-depth examination of the issue of global health. We begin with an analysis of the rise of the international community in addressing population health needs, and the international norms guiding healthcare delivery systems. We will also focus on healthcare delivery systems, technological and scientific innovations, and data science in response to healthcare needs in several developing nations. Finally, students will understand the political, social, and commercial determinants of population health in these countries.

POPH 414 Global Health Research or Field Experience 3 Credits
During this field experience, students will engage in supervised work in global health. Placements will be arranged to suit individual interests and career goals. Potential placements include government agencies, non- profit organizations, the private sector, and other academic institutions that are involved with global health work. A written report and preceptor evaluation will be required.
Repeat Status: Course may be repeated.

POPH 418 Advanced Technologies for Health 3 Credits
This course introduces different technologies related to healthcare, health education, and health promotion. We will explore how the technologies, including computer simulations, serious games, immersive environments (VR/AR), virtual agents, dashboards, eye tracking, emotion detection, and wearable sensors, can be used for health education and promotion. We also discuss the theoretical models and theories guiding the design/use of those technologies.

POPH 419 Population Health Bioethics 3 Credits
This course will focus on macro-level bioethical dilemmas that arise outside the clinic, at the level of the population, the state, the country, or the globe. Population health policies raise questions about autonomy, individual rights, coercion, justice, community, the meaning of the common good, norms of research, and multi-cultural values. The course will explore a range of questions, including: how to conceptualize, measure and evaluate health inequalities?; how should we set spending priorities?; is paternalism acceptable?

POPH 420 (BSTA 420, CGH 420, PUBH 420) Independent Study or Research in Population Health 1-4 Credits
This course can be directed readings or research in Population Health or experiential learning that puts the student's understanding of Population Health into practice. Department permission required.
Repeat Status: Course may be repeated.

POPH 430 Internship in Population Health 1-4 Credits
In this advanced course, graduate students will engage in supervised work in Population Health. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required and a preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

POPH 431 Environmental Health Justice 3 Credits
This course introduces key concepts and methods, such as exposure science, epidemiology, toxicology, biomarkers/omics, risk assessment, implementation science, and policy, in order to deepen the understanding of the relationship between major emerging environmental issues and human health. Specifically, the students will apply key tools to explain the relationship between global-, regional, and local-scale environmental contributors to human health outcomes.

POPH 450 Special Topics in Population Health 3 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

POPH 480 Seminar: Population Health Doctoral Roundtable 1 Credit
In this seminar, students will present their progress and receive peer mentoring on various stages of the research process (e.g. conference presentations, grant applications, manuscripts, dissertation proposal). This seminar will also provide career counseling resources, such as presentations on grant opportunities, the job search process, career networking, interview process, etc. All students will be required to enroll in this seminar until they advance to candidacy and present their dissertation proposal prior to the formal proposal defense with the doctoral committee.
Repeat Status: Course may be repeated.

POPH 481 Seminar: Supervised Research in Population Health 1 Credit
In this seminar, students will work closely with their doctoral advisor or another faculty mentor on supervised research projects. Students will be required to enroll in this seminar in their second semester of the doctoral program and continue to take this course every semester until they advance to the qualifying exam stage.
Repeat Status: Course may be repeated.

Public Health Courses

PUBH 401 Health Promotion and Education 3 Credits
In this course, students will gain a deeper insight into the key conceptual frameworks used in health behavior change, promotion, and education. Students will apply these concepts to specific health behaviors, including tobacco use, alcohol use, substance use, obesity and eating behaviors, physical activity, unintentional injury, workplace injury, violence, and risky sexual behaviors. Students will also explore cross-cutting topics such as behavioral economics, patient and consumer activation, patient communication, cultural competence, risk assessment, chronic conditions and depressive disorders.

PUBH 402 Health Services, Administration, Politics, and Policy 3 Credits
This course will provide students with an overview of how the U.S. healthcare system works. Students will learn the federal, state, and local administration of healthcare services, as well as the implementation process. We will also address the various phases of the health policy-making process, across several sectors. A comparative analysis of the differences between public versus private healthcare service provision will also be provided. We will conclude with comparisons between the US and other countries.

PUBH 403 Health Program Planning and Implementation 3 Credits
Program planning and implementation are essential skills for a public health professional. In this class, students will learn to perform various functions associated with program planning and implementation such as: assess and prioritize community needs; identify evidence-based best practices for choosing interventions; develop and practice writing SMART objectives and logic models; understand how to engage and communicate with stakeholders and community members; as well as how to organize a project budget, staffing plan and timeline.
Prerequisites: PUBH 401 and (EPI 404 or EPI 304)

PUBH 404 Seminar: Leadership and Health Practice 1 Credit
This seminar will introduce students to foundational leadership models and theories that can be applied in a wide range of population and public health practice settings. Students will also learn key leadership skills, including effective interpersonal communication, collaborative decision-making, negotiation, mediation, and team empowerment.
Prerequisites: PUBH 401

PUBH 405 Program Evaluation Methods 3 Credits
Evaluation is an essential public health function and is critically important in the development and maintenance of evidenced-based practice. This interactive, practical course introduces concepts, methodology, and skills used to evaluate health promotion programs. Students will learn how to develop evaluation plans, including process, impact and outcome evaluations. This class will focus on the knowledge and acquisition of skills through assessment, critical analysis, and critique of program evaluations conducted in a range of community health and public health settings.
Prerequisites: PUBH 403

PUBH 410 Applied Practice Experience 3 Credits
Students complete an applied practice experience (APE or "practicum") in a supervised setting consistent with their career goals. With guidance from their site preceptor, students create at least two work products or "deliverables" during their practicum. A final report and oral presentation are also required, and site preceptors evaluate the student's performance.
Prerequisites: PUBH 401

PUBH 411 Public Health Capstone 3 Credits
In consultation with a COH faculty member, students complete a public health capstone project (a.k.a., integrative learning experience (ILE)) that demonstrates synthesis of MPH foundational and concentration competencies. Students produce a high-quality written product (e.g., program evaluation report, training manual, policy statement, legislative testimony with accompanying supporting research, etc.) useful to external stakeholders.
Prerequisites: PUBH 410

PUBH 420 (BSTA 420, CGH 420, POPH 420) Independent Study or Research in Public Health 1-3 Credits
This course can be directed readings or research in Public Health or experiential learning that puts the student's understanding of Public Health into practice. Department permission required.
Repeat Status: Course may be repeated.

PUBH 430 Internship in Public Health 1-3 Credits
In this advanced course, graduate students will engage in supervised work in Public Health. Potential internship sites include government agencies, non-profit organizations, and the private sector. A written report is required and a preceptor evaluation will be required. Department permission required.
Repeat Status: Course may be repeated.

PUBH 450 Special Topics in Public Health 3 Credits
In this course, students will engage in an intensive exploration of a topic of special interest that is not covered in other courses. Topics addressed will be at an advanced level.
Repeat Status: Course may be repeated.

P.C. Rossin College of Engineering and Applied Science

Stephen P. DeWeerth, Dean

John P. Coulter, Senior Associate Dean for Research

Derick G. Brown, Associate Dean for Undergraduate Education

Mark Snyder, Associate Dean for Graduate Education

Kristen Jellison, Associate Dean for Faculty Development

Susan Perry, Assistant Dean for Academic Affairs

The P.C. Rossin College of Engineering and Applied Science offers the bachelor of science degree in 18 programs, combining a strong background in sciences and mathematics with requirements in humanities and social sciences. Students in college programs learn principles they can apply immediately in professional work; those who plan on further academic experience can design a curriculum centering on interests they will pursue in graduate school.

The P.C. Rossin College of Engineering and Applied Science also offers Master's of Science, Master's of Engineering, and Doctor of Philosophy degrees in all of our core departments, as well as several interdisciplinary areas. See Graduate Study and Research (https://catalog.lehigh.edu/graduatestudyandresearch/) for more information.

The mission of the college is to prepare undergraduate and graduate students to be critical thinkers, problem solvers, innovators, leaders and life-long learners in a global society and to create an environment where students pursue cutting-edge research in engineering and engineering science.

DEGREE PROGRAMS
The P.C. Rossin College of Engineering and Applied Science includes eight departments and offers undergraduate and graduate degree programs at the bachelor, master, and doctor of philosophy levels.

The undergraduate degree programs leading to the bachelor of science degree are:

- Applied Science (p. 402)
- Bioengineering (p. 403)[1]
- Chemical Engineering (p. 413)[1]
- Chemistry (p. 103)
- Civil Engineering (p. 421)[1]
- Computer Engineering (p. 434)[1]
- Computer Science (p. 435)[2]
- Computer Science And Business (p. 492)[3]
- Electrical Engineering (p. 449)[1]
- Engineering Mechanics (p. 480)
- Engineering Physics (p. 448)
- Environmental Engineering (p. 421)[1]
- Industrial & Systems Engineering (p. 463)[1]
- Integrated Business And Engineering (p. 498)[4]
- Integrated Degree In Engineering, Arts And Sciences (p. 497)
- Materials Science And Engineering (p. 472)[1]
- Mechanical Engineering (p. 480)[1]

1

Accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

2

Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org

3

Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org and AACSB, the Association to Advance Collegiate Schools of Business

4

Accredited by AACSB, the Association to Advance Collegiate Schools of Business

Programs in chemistry and physics have been approved by the faculty program review committee in these disciplines.

FIRST YEAR COURSES FOR ENGINEERING DEGREES

First Year

First Semester	CR	Second Semester	CR
WRT 001	3	WRT 002	3
MATH 021	4	MATH 022	4
ENGR 005	2	Select one of the following:	5-6
Select one of the following:	5-6	CHM 030 & ENGR 010	6
CHM 030 & ENGR 010	6	PHY 011 & PHY 012	5

PHY 011 & PHY 012	5 HSS Elective	3-4
	14-15	**15-17**

Total Credits: 29-32

Bioengineering students take CHM 030 and ENGR 010 in the fall along with ENGR 005. In the spring they take BIOS 041 (instead of HSS elective) along with PHY 011/PHY 012. The HSS elective will be taken in later semesters.

Students in Computer Science and Business, Integrated Business and Engineering, and Integrated Degree in Engineering, Arts and Sciences follow a different first year curriculum.

MINIMUM HUMANITIES/SOCIAL SCIENCES (HSS) REQUIREMENTS FOR ALL ENGINEERING PROGRAMS

Basic Requirement

Economics and English. Three courses totaling a minimum of ten credit hours: Students must complete all three:

ECO 001	Principles of Economics	4
WRT 001	Academic and Analytical Writing	3
or WRT 003	Composition and Literature I for Multilingual Writers	
WRT 002	Research and Argument	3
or WRT 005	Composition and Literature II for Multilingual Writers	
or WRT 011	Advanced Writing:The Rhetorical Self	
Note: WRT 011 is only for students with AP credit for WRT 001		
Total Credits		**10**

Advanced Requirement

A minimum of four multi-credit courses and a minimum of 13 credits in courses designated as HU (humanities) or SS (social science), with the following restrictions:

1. Depth: At least eight credits must be in a common discipline and from the same department or program. At least three of these credits must be at the 100-level or above, or at the intermediate level or above for a single modern foreign language.
2. Breadth: At least three credits in a discipline different from, and not cross-listed with, the discipline employed to satisfy the depth requirement.
3. At least three credits must be designated as HU.
4. None of the courses used for HSS can be taken Pass/Fail.
5. None of the course can be one-credit courses.

FREE ELECTIVES

The college, through its advisors, is prepared to help students to use the credit hours of “free electives” that, along with other electives in the curriculum, may be used to develop a program of personal interest. Free electives may be satisfied by taking regular course offerings or up to six credit hours from any of the following: MUS 21-79, from JOUR 1-8, or up to six credit hours of advanced ROTC courses.

BACHELOR'S TO MASTER'S ACCELERATED PROGRAMS

The Bachelor's to Master's Accelerated Program allows eligible undergraduates to leverage up to 12 credits taken during undergraduate studies towards a master's degree within the Rossin College (or any of Lehigh's colleges). In addition, the accelerated program allows students to enroll in graduate level (400 level) courses during their junior and senior years.

Master's degrees are becoming increasingly common in the workplace, and graduate study allows students to build new skills or expand existing ones. Students may elect to continue in their undergraduate discipline or change fields. For more information, see: https://engineering.lehigh.edu/academics/undergraduate/special-opportunities/accelerated (https://engineering.lehigh.edu/academics/undergraduate/special-opportunities/accelerated/).

INTERDISCIPLINARY UNDERGRADUATE DEGREES

Computer science & business Honors program

The College of Business and the Computer Science and Engineering department in the P.C. Rossin College of Engineering and Applied Science jointly offer the Computer Science and Business (CSB) Honors program. It is a four-year program that is fully accredited by AACSB International, the Association to Advance Collegiate Schools of Business, and by the Computing Accreditation Commission of ABET, http://www.abet.org .

Integrated Business & Engineering Honors Program

The Integrated Business and Engineering Honors Program (IBE) is offered jointly by the P.C. Rossin College of Engineering and Applied Science and the College of Business. The program recognizes the need for today’s leaders in business and industry to have a sound foundation in both commerce and technology.

After four years and a minimum of 137 credits, students will receive a single Bachelor of Science Degree in Integrated Business and Engineering. The program meets the accreditation standards of the American Assembly of Collegiate Schools of Business. Students are expected to maintain a minimum GPA of 3.25 in order to remain in the program.

A second option is the five-year dual degree program. This option allows students to obtain a second Bachelor of Science degree in engineering by completing course work in the engineering field chosen by the student as their IBE major. Students enrolled in the four year IBE Honors Program and in satisfactory standing are able to transfer to a dual-degree at any time, and stay within the honors program cohort. The additional time necessary to complete the second degree will depend on the curriculum selected, and the number of advanced placement credits. The number of additional credit hours will typically be in the range of 20 to 30.

Students in the IBE Honors Program can major in nearly any area of engineering or business that Lehigh offers. After their freshman year, each student will declare a major in either the P. C. Rossin College of Engineering and Applied Science or the College of Business.

Admission to the Integrated Business and Engineering Program is highly selective, with annual admission limited to approximately 50 students. The University’s Office of Admissions can explain the procedure for applying to the program. It is possible that a small number of exceptional students may be admitted to the program following the completion of their freshman year. Admission at this point would be highly competitive and based upon freshman year GPA, faculty recommendations, and space availability.

The Co-Directors of the IBE Honors Program are Ana Alexandrescu, Professor of Practice, Industrial and Systems Engineering (aia210@lehigh.edu (rhs2@lehigh.edu)) and Richard J. Kish, Professor of Finance (rjk7@lehigh.edu (sgb2@lehigh.edu)). For additional information, see the IBE Honors Program or visit the IBE web site at www.lehigh.edu/~inibep/inibep.html (http://www.lehigh.edu/~inibep/inibep.html).

Integrated Degree Engineering, Arts and Sciences (IDEAS) Honors Program

The B.S. in Integrated Engineering, Arts and Sciences (IDEAS) provides students with a unique opportunity to combine the breadth and depth of two focus areas, one from engineering and one from arts and sciences in a four-year experience. More information is available in the IDEAS entry in this catalog, or online at www.lehigh.edu/ideas (http://www.lehigh.edu/ideas/).

Jointly administered by the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science, IDEAS is a four-year honors program that allows students to earn a bachelor's degree with concentrations in both colleges. In close collaboration with IDEAS advisors and faculty directors, students admitted to this highly selective honors program develop an individualized academic plan tailored to their interests.

IDEAS allows students to study diverse interests such as bioengineering and religion, computer science and graphic design, industrial engineering and international relations, bioengineering and

molecular biology, and music and computer science. Key features of the program include:

- **Rigorous honors program:** Each year, IDEAS accepts 30-40 highly qualified first-year student candidates who have indicated an interest in the program. Students must maintain a 3.25 grade point average to continue.
- **Team-based and individual projects:** Each student builds toward a capstone research project and thesis in their senior year, developed through a combination of team-based and individualized instruction.
- **Communication as key to bridging disciplines:** IDEAS courses are writing-intensive and presentation-oriented. Participation in the program substitutes for some first-year courses in both colleges.

IDEAS graduates are awarded a Bachelor of Science degree, conferred by both colleges. Students interested in pursuing a professionally accredited degree in their selected engineering disciplines may choose to do so in an optional fifth year of study. Some programs of study in the College of Arts and Sciences, mainly in the sciences, may also require further study to complete certification.

OTHER OPTIONS FOR ENGINEERING STUDENTS

Professional work experience

Internships and other professional work experiences are available for undergraduates in the P.C. Rossin College of Engineering and Applied Science. Students interested in experiential employment opportunities should contact the Center for Career and Professional Development and their academic advisor. Students earn free elective credits per successful work assignment for a total of six free elective credits. These six credits are in ENGR 200 (p. 461) or ENGR 160 and are taken as P/F (Pass/Fail).

Technical minors (Available to all students but most require prerequisites from engineering curricula).

Minor Program	Department
Aerospace Engineering	Mechanical Engineering
Biotechnology	Chemical & Biomolecular Engineering
Chemical Engineering	Chemical & Biomolecular Engineering
Computer Engineering	Electrical & Computer Engineering
Computer Science	Computer Science & Engineering
Data Science	Computer Science & Engineering
Electrical Engineering	Electrical & Computer Engineering
Engineering Leadership	Industrial & Systems Engineering
Energy Engineering	Mechanical Engineering
Environmental Engineering	Civil & Environmental Engineering
Manufacturing Systems	Industrial & Systems Engineering
Materials Science	Materials Science & Engineering
Nanotechnology	Materials Science & Engineering
Polymer Science	Materials Science & Engineering

Interdisciplinary Minors (For engineering students)

A minor in Engineering Leadership provides students with knowledge, experiences and interaction with successful business managers in order to become more effective leaders. For more information about this minor: http://www.lehigh.edu/~inleader/curriculum.html

The College of Business offers a minor in Business for students in the College of Arts and Sciences and P.C. Rossin College of Engineering and Applied Science to provide students with knowledge and skills to allow them to make informed business decisions. A sequential sequence of courses is designed to integrate such traditional topics as accounting, finance, marketing, and management. For more information about his minor: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/business-minor (http://cbe.lehigh.edu/academics/undergraduate/degree-programs/business-minor/) . There is a minor in Real Estate: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/real-estate-minor (http://cbe.lehigh.edu/academics/undergraduate/degree-programs/real-estate-minor/) and a minor in Entrepreneurship: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/entrepreneurship-minor (http://cbe.lehigh.edu/academics/undergraduate/degree-programs/entrepreneurship-minor/) . The courses in the latter treat subjects such as intellectual property, creativity and innovation, venture capital, positioning of products and services, and understanding the entrepreneurial mindset. There is also a minor in Supply Chain Management. Details can be found at http://catalog.lehigh.edu/coursesprogramsandcurricula/businessandeconomics/supplychainmanagement/#undergraduatetext

Students in engineering can also earn a minor in various humanities or social sciences by using their humanities and social science electives coupled with their free electives.

Engineering Minor (for non-engineering students)

The College of Engineering enables undergraduate students enrolled in the Colleges of Arts and Sciences and in the College of Business to earn a minor in engineering. This unique program provides students with insight into the world of engineers: who they are, what they do, and how they think. Students pursuing the Engineering Minor develop an understanding of the tools and techniques engineering use on a day-to-day basis.

The mission of the minor is to educate non-engineering students about engineering methodology, specifically how engineers solve problems; how they design, manufacture, and analyze problems; and how other factors such as economics, safety, ethics, and environmental issues affect the engineering design process. Fifteen credit hours of required and elective coursework are required to fulfill the engineering minor.

Music Option

Music and Engineering is not a major in itself. However, Lehigh attracts many engineering and science students who wish to continue their active involvement in music and the music department. For those students who are interested in pursuing this option, music can be taken as a second degree, minor or through free electives.

Undergraduate research through Centers and Institutes

Faculty and students in the college also have research and scholarship activities in a number of centers and institutes, where graduate and undergraduate students work closely with faculty members.

Applied Science

Director, Associate Dean for Undergraduate Education of the P.C. Rossin College of Engineering and Applied Science

The Applied Science Program enables students to create interdisciplinary specialties that prepare them for careers in a world that increasingly bridges academic disciplines. Students pursue subject-area concentrations that represent academic interests they wish to integrate into a meaningful program. The core offers students the intellectual tools to identify connections between the concentrations and engage in interdisciplinary problem-solving and critical thinking.

The program leads to the Bachelor of Science in Applied Science. Each student's curriculum combines a general engineering education with a carefully customized concentration in engineering and/or science as well as another area of emphasis, which may include courses taken inside the P.C. Rossin College of Engineering & Applied Science and may also include courses taken in one or more of the other three Colleges within the University.

In order to ensure the success of this individualized approach to education, Applied Science places primary emphasis on advisement. Each student is teamed with an advisor who helps the student plan the course of study and who supervises independent study and internships. The advisor remains the student's advisor throughout his or her undergraduate career.

Unlike students in the traditional college programs, students in the Applied Science program of individualized study do not declare a major in a particular academic department. Instead, they develop a concentration that may combine study in several areas. Students are encouraged by their advisor to develop the concentration

in such a way that the student will be well prepared for further study in graduate school or for pursuing a particular career path. While the chosen concentration can be highly customized in consultation with the advisor, examples of concentrations include: Technical Communications, Digital Media, Entertainment Science, Technology/Science and Education, Technology/Science and Pre-law, Technology/Science and Pre-Medicine, Technology Management, Technology Marketing, and Engineering and Architecture. Many other combinations are possible.

The requirements for a BS in Applied Science program are a minimum of 128 credit hours including:

First Year Courses		
WRT 001	Academic and Analytical Writing	3
WRT 002	Research and Argument	3
ENGR 005	Introduction to Engineering Practice	2
ENGR 010	Applied Engineering Computer Methods	2
CHM 030	Introduction to Chemical Principles	4
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
MATH 021	Calculus I	4
MATH 022	Calculus II	4
Other Natural Science		
CHM 031	Chemical Equilibria in Aqueous Systems	4
BIOS 041	Introduction to Cellular and Molecular Biology	3
EES 080	Introduction to the Earth System	4
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
Other Mathematics		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
MATH 231	Probability and Statistics	3
Required HSS courses		
ECO 001	Principles of Economics	4
PHIL 128	Philosophy Of Science	4
or HIST 008	Technology in Modern America	
or POLS 106	Environmental Values and Ethics	
PSYC 001	Introduction to Psychology	4
Humanities & Social Science electives		
Select 13 additional credits subject to college requirements.		13
Major electives		
Select 24 credits		24
Approved electives		
Select 18 credits		18
Total Credits		**128**

Arts-Engineering

The Arts-Engineering program provides the student with an opportunity to experience the breadth of a liberal arts education and simultaneously follow the focused curriculum of an engineering major. Students in this five-year, dual degree program are awarded two bachelors degrees, one from the College of Arts and Sciences and another from the College of Engineering and Applied Science, the latter a professional degree.

A typical first-year class schedule for an Arts-Engineering student is shown below.

First Year			
First Semester	**CR**	**Second Semester**	**CR**
WRT 001	3	WRT 002	3
Big Questions Seminar	3-4	ENGR 010	2
ENGR 005	2	MATH 022	4
MATH 021	4	CHM 030	4
PHY 011	4	CAS Major Course or HSS Elective	3-4
PHY 012	1		
	17-18		**16-17**

Total Credits: 33-35

Students are encouraged to select both of their major programs before beginning their sophomore year, and to develop a degree plan that includes requirements for both programs.

Arts-Engineering candidates should recognize that pursuit of a bachelor of science degree (e.g., biology, chemistry, biochemistry, earth and environmental sciences, mathematics, and physics) or a bachelor of arts program with larger than average credit requirements (e.g., architecture, cognitive science, among others) will severely restrict choices of free electives.

For all students, very careful planning of the academic program done in consultation with advisors in both colleges is necessary to guarantee completion of all major, distribution and total credit requirements for the two degrees in five years. When selected carefully, courses meet distribution requirements in the College of Arts and Sciences while also satisfying distribution requirements of the College of Engineering and Applied Science.

A course of study in Arts-Engineering may link any College of Engineering and Applied Science major program with any College of Arts and Sciences major program. Recent combinations include: Political Science and Environmental Engineering; Math and Computer Science; Anthropology and Bioengineering; Architecture and Civil Engineering; Music and Mechanical Engineering. Please see individual departments for details concerning required courses and sequences for completing discipline–specific degrees and combinations of degree requirements for Arts-Engineering.

For more information, please contact Assistant Dean Beth Pelton in the College of Arts & Sciences Undergraduate Advising Office (inadvise@lehigh.edu, 120 Williams Hall) or Dr. Susan Perry (Assistant Dean, P.C. Rossin College of Engineering and Applied Sciences).

Bioengineering

Bioengineering is a broad and rapidly evolving field. At the core of its varied options is the goal of advancing human health through scientific discovery and through the development of new biomedical technologies. The Bioengineering Department at Lehigh offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees in Bioengineering, as well as a Bachelor of Science degree in Bioengineering for undergraduate students.

OUR MISSION

The mission of the Bioengineering Department at Lehigh University is to prepare students to be critical thinkers, problem solvers, innovators, leaders, and life-long learners in the field of Bioengineering. We aim to produce ground-breaking research and new knowledge at the interface of the physical and life sciences, and engineering.

OVERVIEW

As the newest engineering department at Lehigh, we hold true to the Lehigh tradition of world-class excellence in education and research. We accomplish this with outstanding and dedicated faculty members, a vibrant curriculum, state of the art technologies, and a highly integrative and interdisciplinary, research-driven focus.

Lehigh's graduate program in Bioengineering trains students to combine life and physical sciences and engineering to develop effective and affordable solutions for health care and biotechnology

problems. We offer diverse opportunities for advanced studies in areas such as biomaterials, biocomputational engineering, biomechanics, nanotechnology, biosensors, regenerative medicine, and medical devices. Key research themes are (1) Biocomputations and Modeling, (2) Diagnostics, Sensors, and Devices, and (3) Materials and Therapies. Our graduate students are an integral part of this active and multi-disciplinary research environment.

Our undergraduate curriculum in Bioengineering fuses comprehensive fundamentals in engineering and physical sciences, such as fluid mechanics, physics, chemistry and thermodynamics, with a focus on biological systems and bioengineering applications – and then combines it with valuable hands-on, experiential learning opportunities. The result is a rigorous training regimen that prepares our students to be at the forefront of established and emerging fields such as pharmaceuticals, biomaterials, healthcare, biocomputations, bioelectronics, biomedicine and other biotechnology-related industries.

For more information, please visit our website: http://www.lehigh.edu/bioe/

UNDERGRADUATE PROGRAM

PROGRAM EDUCATIONAL OBJECTIVES

The Bioengineering Department has established the following set of Program Educational Objectives for our undergraduate program. Several years after graduation, we expect that:

1. Graduates in professional practice function effectively as responsible and collaborative professionals in Bioengineering or in a related field.

2. Graduates engage in lifelong learning.

STUDENT OUTCOMES

The Bioengineering Department has established that by graduation students will attain:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively with a range of audiences

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

BIOENGINEERING

DESCRIPTION

The B.S. in Bioengineering degree provides a structured curriculum comprised of three tracks. Biopharmaceutical Engineering is for students whose interests lie in genomics, proteomics, bioinformatics, recombinant DNA, protein engineering, bioprocessing, drug synthesis and delivery. The Biocomputational Engineering track covers education and research in the areas of bioinformatics, molecular modeling, signaling in biological systems, and machine learning. The Biomechanics and Biomaterials track encompasses applications of engineering principles to an understanding of biology and physiology, ranging from cells and tissues to organs and systems.

The B.S. in Bioengineering will prepare students for careers in established and emerging fields that require combining engineering principles with the life sciences. Potential paths open to students include the health care, biomedical, pharmaceutical, biomaterials, and other biotechnology related industries through careers in medicine or graduate studies.

The program strongly encourages experiential learning, including two summers of internships, required participation in Lehigh's Capstone Design Projects, and opportunities for undergraduate research for credit.

A total of 132 credit hours are required for graduation with a degree of bachelor of science in bioengineering.

BIOENGINEERING CORE REQUIREMENTS

General Requirements		
ENGR 005	Introduction to Engineering Practice	2
ENGR 010	Applied Engineering Computer Methods	2
WRT 001	Academic and Analytical Writing	3
WRT 002	Research and Argument	3
ECO 001	Principles of Economics	4
Electives to satisfy HSS depth and breadth requirements		13
Free Electives		5
Mathematics		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods [1]	3
MATH 231	Probability and Statistics [1]	3
Natural Sciences		
CHM 030	Introduction to Chemical Principles	4
CHM 031	Chemical Equilibria in Aqueous Systems	4
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	4
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	4
Integrated Bioengineering		
Required by all Three Tracks		
BIOE 110	Elements of Bioengineering	4
BIOE 210	Introduction to Engineering Physiology	4
BIOE 211	Capstone Design Project I	3
BIOE 212	Capstone Design Project II	2
BIOE 225	GMP Good manufacturing practice and regulatory affairs for bioengineers	1
BIOE 226	Ethics in Bioengineering Practice	1
or PHIL 116	Bioethics	
or PHIL 105	Ethics	
Bioengineering Technical Electives [2]		9
Engineering Requirement by Track		
Select one of the following tracks:		
Biopharmaceutical Engineering Track		
CHE 031	Material and Energy Balances of Chemical Processes	3
BIOE 246	Bioengineering Thermodynamics	4
BIOE 247	Biological Fluid Mechanics	4
BIOE 341	Biotechnology I	3
BIOE 343	Integrated Biotechnology Laboratory	3
BIOE 349	Metabolic Engineering	3
or CHE 211	Chemical Reactor Design	
MAT 033	Engineering Materials and Processes	3

CHM 112	Organic Chemistry II	3
BIOE 2XX elective [3]		3
Biocomputational Engineering Track		
CSE 007	Introduction to Programming	0,4
CSE 017	Programming and Data Structures	0,3
BIOC 213	Fundamentals of Biomedical Signals	3
BIOC 237	Introductory Molecular Modeling and Simulation	3
or BIOS 339	Computational, Molecular Modeling and Simulation	
BIOC 309	Bioengineering Applications in Machine Learning	3
BIOE 307	Structural Bioinformatics	3
or BIOE 308	Genomics	
BIOE 363	Numerical Methods for Scientists and Engineers	3
or PHY 380	Introduction to Computational Physics	
BIOS 115	Genetics	0,3
Math-intensive elective [4]		3
Biomechanics and Biomaterials Track		
MECH 003	Fundamentals of Engineering Mechanics	3
MAT 033	Engineering Materials and Processes	3
BIOE 025	Computer-aided Design for Bioengineers	3
BIOE 246	Bioengineering Thermodynamics	4
BIOE 247	Biological Fluid Mechanics	4
BIOE 257	Biomechanics	3
BIOE 311	Introduction to Biomaterials	3
BIOE 357	Integrated Biostructural Mechanics Laboratory	3
Math-intensive elective [4]		3

1

All students must achieve a minimum of a C- in both MATH 205 and MATH 231 for the B.S. in Bioengineering.

2

All students must take nine (9) credits of technical electives. Three (3) of the nine credits must be BIOE electives at the 300-level or higher. The remaining six (6) credits may be engineering courses (any program) at the 200-level or higher, and/or BIOS/CHM/PHY/MATH courses at the 200-level or higher. Other classes that may contribute to the remaining six credits (when not required) include: BIOE 020, BIOE 025, CSE 003, CSE 004, CSE 007, CSE 012, CSE 017, PHY 121, PHY 122, PHY 123, CHM 112, CHM 113, BIOS 115, BIOS 116.
Excluded courses: Courses in professional development, writing, and other non-technical subjects; seminars; BIOS 235.

3

Students in the Biopharmaceutical Engineering track must take one BIOE elective at the 200-level or higher that is not required for their major or track. Excluded courses: BIOE 242, BIOE 290.

4

Select one of the following math-intensive electives: BIOE 315, BIOE 321, BIOE 341, BIOE 345, BIOE 349, BIOE 363, BIOC 213, BIOC 309, or ECE 337.

TYPICAL FOUR-YEAR COURSE SCHEDULE FOR BS IN BIOENGINEERING

BIOPHARMACEUTICAL ENGINEERING TRACK

Freshman

Fall	Credits	Spring	Credits
ENGR 005	2	MATH 022	4
ENGR 010	2	BIOS 041 & BIOS 042	4
MATH 021	4	WRT 002	3
WRT 001	3	Select one from the following:[1]	4-5
Select one from the following:[1]	4-5	CHM 030	-
CHM 030	-	PHY 011 & PHY 012	-
PHY 011 & PHY 012	-		
	15-16		**15-16**

Sophomore

Fall	Credits	Spring	Credits
BIOE 110	4	BIOE 210	4
CHE 031	3	BIOE 246	4
MATH 023	4	MATH 205	3
PHY 021 & PHY 022	5	CHM 031	4
	16		**15**

Junior

Fall	Credits	Spring	Credits
BIOE 225	1	BIOE 211	3
BIOE 341	3	BIOE 247	4
MATH 231	3	BIOE 343	3
CHM 110 & CHM 111	4	CHM 112	3
Technical elective 1	3	ECO 001	4
HSS 1	4		
	18		**17**

Senior

Fall	Credits	Spring	Credits
BIOE 212	2	BIOE 226	1
BIOE 349	3	BIOE 2XX elective	3
MAT 033	3	Technical elective 3	3
Technical elective 2	3	HSS 3	4
HSS 2	4	HSS 4	4
FEE ELECTIVES	2	Free electives	2
	17		**17**

Total Credits: 130-132

1

One course is taken in the fall and the other course is taken in the spring. Consult your adviser.

BIOCOMPUTATIONAL ENGINEERING TRACK

Freshman

Fall	Credits	Spring	Credits
ENGR 005	2	MATH 022	4
ENGR 010	2	BIOS 041 & BIOS 042	4
MATH 021	4	WRT 002	3
WRT 001	3	Select one of the following:[1]	4-5
Select one from the following:[1]	4-5	CHM 030	-
CHM 030	-	PHY 011 & PHY 012	-

PHY 011 & PHY 012	-		
	15-16		**15-16**

Sophomore

Fall	Credits	Spring	Credits
BIOE 110	4	BIOE 210	4
CSE 007	0-4	CSE 017	0-3
MATH 023	4	MATH 205	3
PHY 021 & PHY 022	5	CHM 031	4
		HSS 1	4
	13-17		**15-18**

Junior

Fall	Credits	Spring	Credits
BIOC 237	3	BIOE 211	3
BIOC 309	3	BIOE 363 or PHY 380	3
BIOE 225	1	BIOC 213	3
CHM 110 & CHM 111	4	MATH 231	3
BIOS 115	0-3	ECO 001	4
HSS 2	4		
	15-18		**16**

Senior

Fall	Credits	Spring	Credits
BIOE 212	2	BIOE 226	1
MATH-INTENSIVE ELECTIVE	3	BIOE 308 or 307	3
TECHNICAL ELECTIVE 1	3	TECHNICAL ELECTIVE 2	3
HSS 3	4	TECHNICAL ELECTIVE 3	3
FREE ELECTIVE	4	HSS 4	4
		FREE ELECTIVE	2
	16		**16**

Total Credits: 121-133

1

One course is taken in the fall and the other course is taken in the spring. Consult your adviser.

BIOMECHANICS AND BIOMATERIALS TRACK

Freshman

Fall	Credits	Spring	Credits
ENGR 005	2	MATH 022	4
ENGR 010	2	BIOS 041 & BIOS 042	4
MATH 021	4	WRT 002	3
WRT 001	3	Select one from the following:[1]	4-5
Select one of the following:[1]	4-5	CHM 030	-
CHM 030	-	PHY 011 & PHY 012	-
PHY 011 & PHY 012	-		
	15-16		**15-16**

Sophomore

Fall	Credits	Spring	Credits
BIOE 110	4	BIOE 210	4
MECH 003	3	BIOE 246	4
MATH 023	4	MAT 033	3
PHY 021 & PHY 022	5	MATH 205	3
		CHM 031	4
	16		**18**

Junior

Fall	Credits	Spring	Credits
BIOE 025	3	BIOE 211	3
BIOE 225	1	BIOE 247	4
BIOE 311	3	BIOE 257	3
CHM 110 & CHM 111	4	BIOE 357	3
HSS 1	4	MATH 231	3
Free electives	2		
	17		**16**

Senior

Fall	Credits	Spring	Credits
BIOE 212	2	BIOE 226	1
ECO 001	4	Math-intensive elective	3
Technical elective 1	3	Technical elective 3	3
Technical elective 2	3	HSS 3	4
HSS 2	4	HSS 4	4
		Free electives	3
	16		**18**

Total Credits: 131-133

1

One course is taken in the fall and the other course is taken in the spring. Consult your adviser.

GRADUATE PROGRAM

Bioengineering offers graduate programs leading to a doctor of philosophy or a master of science degree. The graduate programs train students to solve problems that require the application of interdisciplinary knowledge, combining life sciences, physical sciences, and engineering. The programs emphasize cellular and biomolecular science and engineering, and aims to attract students with diverse academic backgrounds. Students may apply for admission to either the doctoral or master's program. Students who do not complete the doctor of philosophy have the option to earn a master of science.

Graduate program objectives

1. Understand complexities and challenges associated with working in the field of Bioengineering with an advanced degree.
2. Demonstrate depth of knowledge in Bioengineering and related fields.
3. Be creators of new knowledge and products in the field of Bioengineering.
4. Succeed in a variety of career paths.

Major Requirements

Doctor of Philosophy Degree

Candidates for the doctor of philosophy degree are required to complete a minimum of 72 credits. The curriculum requirements are defined in the table below. Per university policy, graduate students may count no more than 12 credits at the 300-level toward the Ph.D. degree.

BIOE 452	Mathematical Methods In Engineering I	3
or BIOE 415	Bioengineering Statistics	
or BIOE 463	Numerical Methods for Scientists and Engineers	

BIOE 455	Scientific and Professional Communications for Bioengineers	3
BIOE 410	Advanced Engineering Physiology	3
or BIOE 445	Quantitative Biology	
Adviser-approved technical electives at the 300-level or higher		15
Six credits of dissertation research		6
Additional 42 credits of electives and/or dissertation research		42
Total Credits		**72**

Students must pass a qualification exam, typically taken after three semesters of study, a final written dissertation as well as an oral defense of the dissertation.

Master of Science Degree

An oral defense of thesis research is dependent upon the requirements of the student's adviser.

A minimum of 30 credits is required to complete the Master of Bioengineering degree. The curriculum requirements are defined in the table below. All students are required to complete a common core consisting of three courses, consisting of seven credits: (1) Mathematical Methods in Engineering, Biostatistics, or Numerical Methods for Scientists and Engineers, (2) Professional Development for Bioengineers, and (3) Advanced Engineering Physiology or Quantitative Biology. The remaining 23 credits are electives in Bioengineering and/or other programs. Students wishing to complete a thesis may use six of their electives credits for thesis research, culminating in a written thesis. Per university policy, graduate students may count no more than 12 credits at the 300-level toward the M.S. degree. Additionally, at least eighteen credits must be coursework with a BIOE designation.

Students in the Master of Bioengineering program have the option to focus their studies in one of three concentrations: (1) Biomaterials, (2) Bioengineering Product Development, or (3) Biocomputations and Biomedical Analytics, or alternately pursue a generalized Master of Bioengineering Program. Students in each concentration area take the common Bioengineering core courses, as well as Bioengineering electives.

1. **Biomaterials**: The Biomaterials concentration is for students interested in biological and biomimetic materials, as well as their characteristics and applications. Bioengineering courses in this concentration range from general (Introduction to Biomaterials) to specific, including courses such as Soft Materials: Mechanics and Physics, Cardiovascular Bioengineering, and Introduction to Force Spectroscopy. Beyond Bioengineering, students can further develop their expertise through coursework in Chemical and Biomolecular Engineering and Materials Science and Engineering.
2. **Bioengineering Product Development**: The Bioengineering Product Development concentration is for students interested in the design, development, regulation, and/or commercialization of medical products, including pharmaceuticals and medical devices. Students in this concentration can take Bioengineering courses in Biotechnology, Regulatory Affairs, and Biostatistics, and are encouraged to expand the breadth of their knowledge by taking courses in Industrial and Systems Engineering, Project Management, Technical Entrepreneurship, and General Business. Students in this track are required to complete a Bioengineering Projects course under the guidance of faculty, often under the mentorship of an industry or clinical partner.
3. **Biocomputations and Biomedical Analytics**: The Biocomputations and Biomedical Analytics concentration is for students interested in the rapidly growing field of computational data sciences, as applied to biotechnology, biological systems, and biopharmaceutical development. Examples of Bioengineering courses in this concentration include Biostatistics, Bioengineering Applications in Machine Learning, Molecular Modeling and Simulations, and Numerical Methods for Scientists and Engineers. To further develop their expertise, students are also encouraged to take courses in Industrial and Systems Engineering and Computer Science and Engineering.

BIOE 452	Mathematical Methods In Engineering I	3
or BIOE 415	Bioengineering Statistics	
or BIOE 463	Numerical Methods for Scientists and Engineers	
BIOE 453	Professional Development for Bioengineers	1
BIOE 410	Advanced Engineering Physiology	3
or BIOE 445	Quantitative Biology	
Bioengineering electives at the 300-level or higher		11
Adviser-approved electives		12
Total Credits		**30**

Bio Engineering Courses

BIOE 020 Bioengineering Sophomore Research Seminar 1 Credit
Exposure to opportunities for on-campus research in bioengineering. Review of current literature on bioengineering topics through written reports and/or oral presentations. Preparation of written research proposal, including definition of topic, objectives, methodologies, research plans, and expected impact.

BIOE 025 Computer-aided Design for Bioengineers 0,3 Credits
Introduction to computer-aided design and analysis using SolidWorks software. Best design practices and hands-on experience in building parts, assemblies, and creating technical 2D drawings. Applications important in the medical product industry, such as diagnostic and clinical equipment, surgical tools, implants, drug delivery systems, and pharmaceutical packaging systems.

BIOE 110 Elements of Bioengineering 0,4 Credits
An introduction to the fields of biotechnology and biomedical engineering. The areas include biomechanics, biomaterials, bioinstrumentation, medical imaging, rehabilitation engineering, biosensors, biotechnology and tissue engineering.
Prerequisites: BIOS 041

BIOE 210 Introduction to Engineering Physiology 0,4 Credits
Mammalian physiology for bioengineering students, with an emphasis on control mechanisms and engineering principles. Basic cell function; biological control systems; muscle; neural; endocrine, circulatory, digestive, respiratory, renal, and reproductive systems; regulation of metabolism and defense mechanisms. Includes laboratory work.
Prerequisites: (BIOS 041 and BIOS 042) and MATH 022

BIOE 211 (BIOC 211, ENGR 211, MAT 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
Prerequisites: BIOE 110 and BIOE 210 and (CHE 031 or MECH 003 or ECE 081)
Can be taken Concurrently: BIOE 210

BIOE 212 (BIOC 212, ENGR 212, MAT 212, ME 212) Capstone Design Project II 2 Credits
Students continue developing their solutions from BIOE 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
Prerequisites: BIOE 211 and BIOE 225
Can be taken Concurrently: BIOE 225

BIOE 225 GMP Good manufacturing practice and regulatory affairs for bioengineers 1 Credit
Review of the principles of the Food and Drug Administration including its history, mission and applied regulations. Understanding of how the FDA works with industry and is integral to the development of new products and technologies. Review and critique of case studies in various parts of the biomedical industry to see how FDA regulations are applied. Validation and analysis of products using failure mode analysis.
Prerequisites: BIOE 110

BIOE 226 Ethics in Bioengineering Practice 1 Credit
Introduction to ethical principles and role of critical thinking in ethical decision-making. Analysis of contemporary issues in bioengineering practice. Topics include biomedical device risk and failure, ethics of clinical trials, animal research, human enhancement, and research conduct.

BIOE 242 Bioengineering Research 1-4 Credits
Research on a topic chosen by students, with a faculty advisor typically from the three bioengineering tracks (biopharmaceutical engineering, bioelectronic/biophotonics or biomechanics and biomaterials). Independent meetings with advising professor will track progress. Includes written reports and/or oral presentations. Consent of instructor required.
Repeat Status: Course may be repeated.

BIOE 246 Bioengineering Thermodynamics 0,4 Credits
Engineering thermodynamics principles and their application to biological systems. Fundamental thermodynamics concepts, first and second law principles, conservation laws, properties of pure substances and biochemical mixtures under physiological conditions, energy conversion systems, thermodynamic aspects of biological processes.
Prerequisites: PHY 011 and MATH 022 and CHM 031
Can be taken Concurrently: CHM 031

BIOE 247 Biological Fluid Mechanics 0,4 Credits
Fluid and mass transport and their applications in biological systems. Mass conservation. Momentum and energy balances in fluid flow. Incompressible fluid flow with inviscid and viscous applications. Dimensional analysis. Fluid flow in pipes and porous media. Diffusion and convection.
Prerequisites: MATH 205

BIOE 257 Biomechanics 3 Credits
Overview of biomechanics. Application of fundamental laws of mechanics to biological systems. Systems examined include: strength of materials, biomechanics of cells, biomechanical analysis of tissues, rigid body kinematics, microstructure of materials and resultant mechanical properties, concepts of force and mechanics of rigid and deformable bodies, and failure processes of implantable biomaterials/devices. Exposure to current research in the field.
Prerequisites: MAT 033 and MECH 003 and MATH 205
Can be taken Concurrently: MATH 205

BIOE 290 Bioengineering Thesis 1-3 Credits
Thesis, guided by a faculty advisor, based on research and/or design projects. Independent meetings with advising professor to track progress. Consent of instructor required.
Prerequisites: BIOE 242 or TE 212

BIOE 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

BIOE 307 (CSE 307) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and -DNA interactions; molecular simulation, electrostatics. Tutorials on UNIX systems and research software support an interdisciplinary collaborative project in computational structural biology. Credit will not be given for both CSE 307 and CSE 407. Must have junior standing or higher.
Prerequisites: BIOS 120 or CSE 109 or CHM 113 or MATH 231
Attribute/Distribution: Q

BIOE 308 (CSE 308) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017
Attribute/Distribution: ND

BIOE 310 Advanced Engineering Physiology 3 Credits
An in-depth examination of human physiological processes using a quantitative, model-oriented approach. Organ systems examined include the nervous, musculoskeletal, cardiovascular, respiratory, renal, immune, and endocrine systems. Mathematical models, computer simulations, and engineering analyses will be used to describe the performance of human organ systems and to study physiological processes.
Prerequisites: MATH 205 and BIOE 210

BIOE 311 (MAT 311) Introduction to Biomaterials 3 Credits
Application of materials science and engineering principles to biomedical materials with a focus on polymers, ceramics, and metals. Synthesis and fabrication of biomaterials, structure-property-function relationships related to biocompatibility and bioactivity; nano- to macro-scale characterization; material-tissue interactions; and applications of biomaterials including implants, devices, drug delivery, tissue engineering and regenerative medicine.
Prerequisites: MAT 033

BIOE 315 (ME 315) Bioengineering Statistics 3 Credits
Advanced methods in probability and statistics applied to bioengineering problems focusing on modeling and data analysis. Topics include the following: types of data, types of distributions, parametric and nonparametric analyses, goodness-of-fit, regression, power analysis, and multivariate analysis, life models, simulation, cluster analysis, and Bayesian statistics. Special emphasis is placed on projects and case studies.
Prerequisites: MATH 231

BIOE 316 (ME 316) Introduction to Force Spectroscopy 3 Credits
Fundamentals of major force spectroscopy methods, including atomic force microscopy, optical tweezers, and magnetic tweezers. Principles of force measurement, force calibration, and signal and noise. Applications to the mechanical properties of biomaterials, such as polymer elasticity, protein folding, nanoindentation, and structural transitions in macromolecules. Closed to students who have taken BIOE 416.
Prerequisites: MECH 003

BIOE 318 (CHE 318, MAT 318) Soft Materials: Rheology and Characterization 3 Credits
Characterization of soft materials using rheological techniques. Fundamentals of rheology and rheological characterization applied to materials such as polymers, glassy liquids and polymeric gels. Closed to students who have taken CHE/BIOE/MAT 418. Instructor permission or graduate status required.

BIOE 320 (CSE 320) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. Credit will not be given for both BioE 320 and BioE 420.
Prerequisites: (MATH 205 or MATH 043) and CSE 017
Attribute/Distribution: Q

BIOE 321 Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of the components of the cell, ranging in length scale from fundamental biomolecules to the entire cell. The course covers the mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell.
Prerequisites: MATH 205 and MATH 231 and PHY 022 and (PHY 013 or PHY 021 or PHY 023)

BIOE 324 (MAT 324) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular and system level; general introduction to biosensors, drug delivery devices and tissue engineering.
Prerequisites: BIOE 110

BIOE 325 (MAT 325) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implants and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis).
Prerequisites: MAT 033

BIOE 326 (MAT 326) Biomimetic and Bio-enabled Materials 3 Credits
The structure, function, properties and use of biopolymers, biocomposites, and biominerals. Biomimetic materials design, including colloids, interfaces, macromolecules, and applications of such materials. Environmental and ethical considerations, such as degradation products when using biomimetic materials. Closed to students who have taken MAT 426 (BioE 426).
Prerequisites: MAT 033 or BIOE 110
Attribute/Distribution: ND

BIOE 331 Integrated Bioelectronics/Biophotonics Laboratory 2 Credits
Experiments in design and analysis of bioelectronics circuits, micropattering of biological cells, micromanipulation of biological cells using electric fields, analysis of pacemakers, instrumentation and computer interfaces, ultrasound, optic, laser tweezers and advanced imaging and optical microscopy techniques for biological applications.
Prerequisites: (ECE 081 or PHY 190) and (PHY 013 or PHY 021 or PHY 023) and PHY 022 and ECE 121 and ECE 123
Can be taken Concurrently: ECE 121, ECE 123

BIOE 339 Neuronal Modeling and Computation 3 Credits
Neuroscience in a computational, mathematical, and engineering framework. Literature surveys and case studies with simulations. Computational aspects of information processing within the nervous system by focusing on single neuron modeling. Single neurons and how their biological properties relate to neuronal coding. Biophysics of single neurons, signal detection and signal reconstruction, information theory, population coding and temporal coding.
Prerequisites: ENGR 010 and MATH 205

BIOE 341 (CHE 341) Biotechnology I 3 Credits
Applications of material and energy balances; heat, mass, and momentum transfer; enzyme and microbial kinetics; and mathematical modeling to the engineering design and scale-up of bio-reactor systems. Closed to students who have taken CHE 441 (BIOE 341 and BIOE 441).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

BIOE 342 (CHE 342) Biotechnology II 3 Credits
Engineering design and analysis of the unit operations used in the recovery and purification of products manufactured by the biotechnology industries. Requirements for product finishing and waste handling will be addressed. Closed to students who have taken CHE 442 (BIOE 342 and BIOE 442).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

BIOE 343 Integrated Biotechnology Laboratory 0,3 Credits
Biosafety, sterilization, media formulation, biochemical and enzyme assays, recombinant DNA technique, protein and DNA isolation and purification, for microbial fermentation and animal cell culture. Integration of biotechnology techniques for biopharmaceutical production. Consent of instructor required.
Prerequisites: BIOE 110 and (CHE 341 or BIOE 341)

BIOE 344 (CHE 344) Molecular Bioengineering 3 Credits
Kinetics in small systems, stochastic simulation of biochemical processes, receptor-mediated adhesion, dynamics of ion-channels, ligand binding, biochemical transport, surface Plasmon resonance, DNA microarray design, and chemical approaches to systems biology. Senior standing in BIOE.
Prerequisites: (MATH 205 and MATH 231)

BIOE 345 (CHE 345) Quantitative Biology 3 Credits
Basic concepts in molecular and cellular biology as well as biochemistry. Connects these to engineering principles to (1) develop a quantitative understanding of biological systems and (2) understand how modern engineering uses applications of methods and principles in biology. Topics include quantity and length scales in biology, use of statistical mechanics to describe phenomena such as microstates and ligand receptor binding, and application of chemical reaction kinetics to describe biochemical reactions. Closed to students who have taken BIOE 445.
Prerequisites: MATH 205

BIOE 348 Cardiovascular Bioengineering 3 Credits
Review of current and emerging trends in cardiac and vascular device development. Topics include cardiovascular anatomy and physiology principles, molecular and systemic basis of cardiovascular pathologies, techniques for diagnosis and surgical management of select disease manifestations. Medical, bioengineering and biologic parameters influencing the design and selection of interventional devices and endovascular prosthetics, as well as the engineering tools necessary for their evaluation. Consideration of factors contributing to device failure and state of the art in experiments and human clinical trials.
Prerequisites: BIOE 210 and BIOE 247

BIOE 349 Metabolic Engineering 3 Credits
Quantitative perspective of cellular metabolism and biochemical pathways. Methods for analyzing stoichiometric and kinetic models, mass balances, flux in reaction networks, and metabolic control. Solving problems using advanced mathematics and computer programming.
Prerequisites: MATH 205

BIOE 350 Special Topics 1-4 Credits
Special topics of study in bioengineering. Permission of Instructor.
Repeat Status: Course may be repeated.

BIOE 357 Integrated Biostructural Mechanics Laboratory 3 Credits
Experimental manipulation and analysis of mammalian cells, with a focus on the biomechanical properties of cells, the interface of living and non-living materials, and on bioengineering applications. Experimental techniques include mammalian cell culture, advanced microscopy techniques, preparation of bioactive substrates, microfluidic device fabrication, micropatterning of cells and cell growth in 3D matrices. Consent of instructor required.
Prerequisites: BIOE 110

BIOE 363 (CHE 363) Numerical Methods for Scientists and Engineers 3 Credits
Introduction to numerical methods in science and engineering. Expose students to the numerical solution of a variety of commonly encountered problems, enhance their numerical programming skills, and provide a broad base on which to build more specialized knowledge of computational methods. Topics include solution of linear and nonlinear sets of algebraic equations, linear and logistic regression, ordinary differential equations, Fourier analysis, eigenvalues, partial differential equations by finite difference and finite element methods.
Prerequisites: MATH 205

BIOE 366 (ECE 366) Neural Engineering 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 466, ECE 366, or ECE 466.
Prerequisites: ECE 081

BIOE 367 (CHE 367) Engineering in Medicine 3 Credits
Introduction to the physical basis of disease. Discussion of biomolecular strategies to overcome these changes. Topics include drug delivery, targeting, and tissue engineering, with a focus on infectious disease, cancer, cardiovascular disease, and neurodegenerative disease. Closed to students who have taken CHE 467 (BIOE 367 and BIOE 467).

BIOE 368 (ECE 368) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken BIOE 468, ECE 368, or ECE 468.
Prerequisites: ECE 202 or PHY 212

BIOE 369 (CHE 369) Advanced Topics in Regulatory Affairs 3 Credits
Regulatory requirements for the development and manufacture of 21st century medical products. Current challenges and innovative technologies in pharmaceuticals and medical devices. Topics include combination products, biosimilars, cell therapeutics, mobile medical applications, 3D-printed products, big data in healthcare, new approaches to process validation. Closed to students who have taken BIOE/CHE 469.
Prerequisites: BIOE 225

BIOE 370 (CHE 370) The Engineering of Brewing, Winemaking, and Distilling 0,3 Credits
An open-ended and experiential exploration of the engineering principles required for the brewing of beer, winemaking, and distilling of spirits.
Prerequisites: (BIOE 341 or CHE 211) and (BIOE 246 or CHE 212)

BIOE 372 Drug Delivery and Nanomedicine 3 Credits
Fundamental principles of controlled drug delivery, including drug release systems and their mechanisms, physiological barriers, and routes of delivery. Impact of nanotechnology on designing advanced drug delivery technologies, such as targeted drug therapies, controlled release systems for tissue engineering/ regenerative medicine, and non-viral gene delivery systems. Credit will not be given for both BIOE 372 and 472.
Prerequisites: MATH 022 and CHM 031

BIOE 373 Tissue Engineering and Regenerative Medicine 3 Credits
Introduction to tissue engineering and regenerative medicine principles used to develop potential treatments for broad range of injuries and pathologies. Building blocks for engineering tissues, including cells, biomaterials, and bioactive cues. Criteria for selection of cell source, scaffold design and fabrication methods, and tools for control of cellular microenvironment. Consideration of economic, social, and ethical aspects of tissue engineering. Credit will not be given for both BIOE 373 and BIOE 473.
Prerequisites: CHM 031

BIOE 383 Introduction to Bioimaging and Microscopy 0,3 Credits
Principles, technologies, and instrumentation of numerous modern imaging modalities, including X-ray, computed tomography, magnetic resonance imaging, ultrasound, and positron emission tomography. Fundamental concepts to advanced systems and their applications. Hands-on experience with advanced research microscopes and exposure to cutting edge imaging instrumentation. Discussion of articles in current literature. Credit will not be given for both BIOE 383 and BIOE 483.
Prerequisites: PHY 021

BIOE 407 (CSE 407) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and –DNA interactions; molecular simulation, electrostatics. This course, a version of 307 for graduate students, requires advanced assignments and a collaborative project. Credit will not be given for both BIOE 307 and 407. Consent of instructor required.

BIOE 408 (CSE 408) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. This course, a version of 308 for graduate students requires advanced assignments. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018
Attribute/Distribution: ND

BIOE 409 Bioengineering Applications in Machine Learning 3 Credits
This course is a graduate-level version of BIOC 309.While the lecture content will be the same as the 300-level course, students enrolled in BIOC 409 will have more advanced assignments. Closed to students who have taken BIOC 309.

BIOE 410 Advanced Engineering Physiology 3 Credits
This course is a graduate-level version of BIOE 310.While the lecture content will be the same as the 300-level course, students enrolled in BIOE 410 will have more advanced assignments. Closed to students who have taken BIOE 310.

BIOE 411 (MAT 411) Introductions to Biomaterials 3 Credits
Application of materials science and engineering principles to biomedical materials with a focus on polymers, ceramics, and metals. Synthesis and fabrication of biomaterials, structure-property-function relationships related to biocompatibility and bioactivity; nano- to macro-scale characterization; material-tissue interactions; and applications of biomaterials including implants, devices, drug delivery, tissue engineering and regenerative medicine. MAT 411 will require project-based study. Credit will not be given for both MAT 311 and MAT 411.
Prerequisites: MAT 033

BIOE 415 Bioengineering Statistics 3 Credits
Advanced methods in probability and statistics applied to bioengineering problems focusing on modeling and data analysis. Topics include the following: types of data, types of distributions, parametric and nonparametric analyses, goodness-of-fit, regression, power analysis, and multivariate analysis, life models, simulation, cluster analysis, and Bayesian statistics. Special emphasis is placed on projects and case studies. Credit can not be received for both BIOE/ME 315 and BIOE 415.

BIOE 416 Introduction to Force Spectroscopy 3 Credits
This course is a graduate version of BIOE 316 (ME 316). While the lecture content will be the same as the 300-level course, students in the 400-level class will be expected to complete more advanced assignments. Closed to students who have taken BIOE 316 (ME 316).

BIOE 417 (CHE 417, MAT 417) Soft Materials: Mechanics and Physics 3 Credits
Physical and mechanical behavior of soft materials such as gels, foams, rubbers, soft adhesives, and most biological tissue. Large strain kinematics, stress measures, constitutive relations from the molecular and continuum points of view, and application to problems such as cavitation, creasing, thin structures, fracture, adhesion, surface stress, and electroactive materials.
Prerequisites: CHE 452 or ENGR 452

BIOE 418 (CHE 418, MAT 418) Soft Materials: Rheology and Characterization 3 Credits
See the course description listed for CHE/BIOE/MAT 318. In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE/BIOE/MAT 318.

BIOE 420 (CSE 420) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. This course, a graduate version of BioE 320, requires additional advanced assignments. Credit will not be given for both BioE 320 and BIOE 420.
Prerequisites: MATH 205 and CSE 109
Attribute/Distribution: ND

BIOE 421 (CHE 421) Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of cell components, from fundamental biomolecules to the entire cell. The mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell. This course is a graduate version of ChE 321 (BioE/Phy 321). The lecture content will be the same as in ChE 321 (BioE/Phy 321), but students enrolled in ChE 421 (BioE 421) will have more advanced assignments. Closed to students who have completed ChE 321 (BioE/Phy 321). Must have graduate standing.

BIOE 424 (MAT 424) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication, and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular, and system level; general introduction to biosensors, drug delivery, and tissue engineering. Graduate version of BioE 324 requiring additional assignments. Credit is not given for both BioE 324 (MAT 324) and BioE 424 (MAT 424).
Prerequisites: MAT 033

BIOE 425 (MAT 425) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis). Graduate version of MAT 325; credit will not be given for both MAT 325 and MAT 425.
Prerequisites: MAT 033

BIOE 426 (MAT 426) Biomimetic and Bio-enabled Materials 3 Credits
This course is a graduate version of BIOE 326 (MAT 326). While the lecture content will be the same as the 300-level course, students enrolled in BIOE 426 (MAT 426) will have more advanced assignments. Closed to students who have taken BIOE 326 (MAT 326). Must have graduate standing in Bioengineering or Materials Science and Engineering.
Attribute/Distribution: ND

BIOE 439 (CHE 439) Neuronal Modeling and Computation 3 Credits
This course is a graduate version of BIOE 339 (CHE 339). While the lecture content will be the same as the 300-level course , students in the 400-level class will be expected to complete an independent term project. Closed to students who have completed BIOE 339 (CHE 339). Must have graduate standing in Bioengineering or Chemical Engineering.

BIOE 441 (CHE 441) Biotechnology I 3 Credits
See the course description listed for BioE 341. In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken BioE 341 (CHE 341).

BIOE 442 (CHE 442) Biotechnology II 3 Credits
See the course description listed for BIOE 342 (CHE 342). In order to receive 400-level credit, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken BIOE 342 (CHE 342).

BIOE 445 (CHE 445) Quantitative Biology 3 Credits
This course is a graduate-level version of BIOE 345. While the lecture content will be the same as the 300-level course, students enrolled in BIOE 445 will have more advanced assignments. Closed to students who have taken BIOE 345.

BIOE 447 (CHE 447) Molecular Bioengineering 3 Credits
This course is a graduate version of CHE 344 (BioE 344). While the lecture content will be the same as the 300-level course, students enrolled in CHE 447 will have more advanced assignments. Closed to students who have completed BioE 344 (CHE 344).

BIOE 448 Cardiovascular Bioengineering 3 Credits
This course is a graduate-level version of BIOE 348.While the lecture content will be the same as the 300-level course, students enrolled in BIOE 448 will have more advanced assignments. Closed to students who have taken BIOE 448.

BIOE 449 (CHE 449) Metabolic Engineering 3 Credits
This course is a graduate version of BIOE 349. While the lecture content will be the same as the 300-level course, students enrolled in BIOE 449 (CHE 449) will have more advanced assignments. Closed to students who have completed BIOE 349. Must have graduate standing in Chemical Engineering or Bioengineering.

BIOE 450 Special Topics 1-3 Credits
Special topics of study in bioengineering. Permission of instructor.

BIOE 451 Bioengineering Research Projects 1-6 Credits
Bioengineering-related research projects, based upon faculty and student interest. Projects may involve interaction with industry or local communities. Department permission required. A maximum of 6 credits of BIOE 451 can be used toward degree requirements.
Repeat Status: Course may be repeated.

BIOE 452 (CHE 452, ENGR 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

BIOE 453 Professional Development for Bioengineers 1 Credit
This course, designed for students enrolled in a Master's program in Bioengineering, provides the professional skills necessary to prepare students for full-time employment in industry, or alternatively, for enrollment in a doctoral program towards a research career. Topics covered include resume development, networking and interviewing skills, awareness of current and emerging professional opportunities, biomedical ethics, and technical/scientific communication.

BIOE 455 Scientific and Professional Communications for Bioengineers 3 Credits
Development and practice of critical reading skills through study of articles in the current bioengineering literature, including their societal, regulatory, and real-world context. Build capabilities in analytical and creative thinking and scientific communication, including best practices for presenting data for journal articles, writing research proposals, presenting professional talks and seminars, and understanding the manuscript and proposal review process. Formulate an individual development plan to guide technical and professional development, and provide a framework for communicating with advisers, mentors, and colleagues.

BIOE 456 (CHE 456) Stochastic Processes: Theory and Applications in Biology 3 Credits
Stochastic, or probabilistic, models of cellular processes and other biological systems to describe the inherent randomness of nature. Topics covered include theory and biological applications of Markov chains, the Master Equation, white noise and stochastic integrals, the Fokker-Planck Equation, and noise in gene expression. Some minimal experience in programming and/or Mathematica/Matlab.
Prerequisites: MATH 205

BIOE 463 (CHE 463) Numerical Methods for Scientists and Engineers 3 Credits
See the course description listed for ChE 363 (BIOE 363). This course is graduate version of ChE 363 (BIOE 363). The lecture content will be the same as ChE 363 (BIOE 363), but students enrolled in ChE 463 (BIOE 463) will have more advanced assignments. Closed to students who have taken ChE 363 (BIOE 363). Must have graduate standing or consent of the instructor.

BIOE 466 (ECE 466) Neural Engineering 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 366, ECE 366, or ECE 466. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

BIOE 467 (CHE 467) Engineering in Medicine 3 Credits
See the course description listed for CHE 367 (BIOE 367). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 367 (BIOE 367), or BIOE 467.

BIOE 468 (ECE 468) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken BIOE 368, ECE 368, or ECE 468. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

BIOE 469 (CHE 469) Advanced Topics in Regulatory Affairs 3 Credits
This course is a graduate version of BIOE 369 (CHE 369). While the lecture content will be the same as the 300-level course, students enrolled in BIOE 469 (CHE 469) will have more advanced assignments. Closed to students who have taken BIOE/CHE 369.

BIOE 472 Drug Delivery and Nanomedicine 3 Credits
This course is a graduate-level version of BIOE 372. While the lecture content will be the same as BIOE 372, students enrolled in BIOE 472 will have more advanced assignments. Credit will not be given for both BIOE 372 and BIOE 472.

BIOE 473 Tissue Engineering and Regenerative Medicine 3 Credits
This course is a graduate-level version of BIOE 373. While the lecture content will be the same as BIOE 373, students enrolled in BIOE 473 will have more advanced assignments. Credit will not be given for both BIOE 373 and BIOE 473.

BIOE 483 Introduction to Bioimaging and Microscopy 0,3 Credits
This course is a graduate-level version of BIOE 383. While the lecture content will be the same as BIOE 383, students enrolled in BIOE 483 will have more advanced assignments. Credit will not be given for both BIOE 383 and BIOE 483.

BIOE 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

BIOE 499 Dissertation 1-12 Credits

Biocomputational Engineering Courses

BIOC 211 (BIOE 211, ENGR 211, MAT 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
Prerequisites: CSE 007 and BIOC 237
Can be taken Concurrently: BIOC 237

BIOC 212 (BIOE 212, ENGR 212, MAT 212, ME 212) Capstone Design Project II 0,2 Credits
Students continue developing their solutions from BIOC 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
Prerequisites: BIOC 211 and BIOC 309
Can be taken Concurrently: BIOC 309

BIOC 213 Fundamentals of Biomedical Signals 3 Credits
Fundamentals of analysis of data obtained from common quantitative techniques, including imaging, EEG, cardiograms, and bioinformatics. Introduction to sampling, Fourier transforms, filters, clustering, and classification. Common tools for data processing and application of programming.
Prerequisites: MATH 205 and PHY 021 and BIOE 210
Can be taken Concurrently: BIOE 210

BIOC 214 Fundamentals of Biological Modeling 3 Credits
Introduction to quantitative biology approaches through modeling. Practical methods of applying basic mathematical modeling and programming. Topics include linear and non-linear models, DNA and protein structures, ligand-receptor binding, reaction kinetics, electrical and mechanical cell dynamics, gene regulatory models, and fundamentals of epidemiology.
Prerequisites: MATH 205 and CSE 017 and PHY 021

BIOC 237 (BIOS 237) Introductory Molecular Modeling and Simulation 3 Credits
Key concepts, methods, and tools used in molecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.Key concepts, methods, and tools used in molecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.
Prerequisites: CHM 030 or CHM 040
Attribute/Distribution: NS

BIOC 240 Biocomputational Engineering - Capstone 1 3 Credits
Students work in teams on design projects in which they will integrate and apply concepts from numerous courses in the Biocomputational Engineering curriculum. Projects have constraints, including technical feasibility, engineering standards, and economic analysis, as well as global and/or social impact.
Prerequisites: BIOC 214 and BIOC 236

BIOC 241 Biocomputational Engineering - Capstone 2 3 Credits
Students continue their work on Biocomputational Engineering design projects from BIOC 240. Designs from the previous semester will be further developed, such that they have more technical depth and adhere to established constraints and standards.
Prerequisites: BIOC 240

BIOC 309 Bioengineering Applications in Machine Learning 3 Credits
Introduction to machine learning and AI techniques as well as their applications in biomedical data quantification, prediction, and visualization. Topics include principles of bioengineering data modalities and systems, fundamentals of machine learning approaches for biomedical data analysis, such as denoising, standardization, statistical analysis, dimensionality reduction, predictive modeling, as well as computational tools for implementing AI methods.
Prerequisites: MATH 205 and PHY 021

Chemical and Biomolecular Engineering

https://engineering.lehigh.edu/chbe

The Chemical and Biomolecular Engineering Department offers a Bachelor of Science degree in chemical engineering to undergraduate students and offers graduate programs leading to the master of science, master of engineering, and doctor of philosophy degrees in Chemical Engineering, and master of engineering degrees in Biological Chemical Engineering and Chemical Energy Engineering.

Modern chemical engineering is built around the fundamental enabling sciences of biology, chemistry, physics, and mathematics. Its curriculum encompasses three basic organizing principles: Molecular Transformations, Multi-scale Analysis, and System Approaches. Chemical engineers serve a wide variety of technical and managerial functions within the chemical processing industry. For a lifetime of effectiveness they need a sound background in the fundamental sciences of chemistry and physics; a working capability with mathematics, numerical methods, and application of computer solutions; and a broad education in humanities, social sciences, and managerial techniques. These bases are applied in a sequence of chemical engineering courses in which logic and mathematical manipulation are applied to chemical processing problems. With the resulting habits of precise thought coupled to a broad base in scientific and general education, Lehigh graduates have been effective throughout industry and in advanced professional education. No effort is made toward any specific industry, but adaptation is rapid and the fundamental understanding forms the base for an expanding career.

The program is also designed to prepare a student for graduate study in chemical and biomolecular engineering. Further study at the graduate level leading to advanced degrees is highly desirable if an individual wishes to participate in the technical development of the field. The increasing complexity of modern manufacturing methods requires superior education for men and women working in research, development, and the design fields or for teaching.

PHYSICAL FACILITIES

The Chemical and Biomolecular Engineering Department is the only engineering department located on Lehigh's 780 acres Mountaintop Campus. Here the department occupies approximately one-third of Iacocca Hall, the 200,000-square-foot flagship building that contains offices, classrooms, and laboratories. Additional plant facilities, and the undergraduate chemical processing laboratory occupy approximately 10,000-square-feet in the nearby Imbt building.

These facilities provide excellent support for a wide range of general and special laboratory equipment for undergraduate and graduate studies of the behavior of typical chemical processing units; bioengineering research; nanotechnology; energy; biochemical engineering; polymers; digital computation for process dynamics research; and study of thermodynamics, kinetics, heat transfer, and mass transfer.

The Chemical and Biomolecular Engineering department has established a senior design laboratory in Iacocca Hall featuring 35 PCs, which is dedicated to undergraduate process design courses.

UNDERGRADUATE PROGRAM

The mission of the undergraduate program is "to educate students in the scientific principles of chemical and biomolecular engineering and provide opportunities to explore their applications in the context of a humanistic education that prepares them to address technological and societal challenges."

PROGRAM EDUCATIONAL OBJECTIVES

To achieve its educational mission, the Department of Chemical and Biomolecular Engineering has established the following set of Program Educational Objectives: Graduates of the Undergraduate Program in Chemical Engineering will:

1. Apply their broad education in chemical engineering to pursue careers in industry, government agencies, consulting firms, educational institutions, financial institutions, business, law, and medicine.
2. Pursue graduate studies, research, or continuing education.
3. Be sensitive to the social, ethical, and technical implications of their work as it affects the environment, safety, and health of citizens worldwide.

In order to achieve these program educational objectives, the chemical engineering program ensures that the graduates are capable of the following Student Outcomes proposed by the accreditation organization ABET:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

CAREER OPPORTUNITIES

Chemical engineers play important roles in all activities bearing on the chemical process industry. These include the functions of research, development, design, plant construction, plant operation and management, corporate planning, technical sales, and market analysis.

The industries that produce chemical and/or certain physical changes in fluids, including petroleum and petrochemicals, rubbers and polymers, pharmaceuticals, bioengineering, metals, industrial and fine chemicals, foods, and industrial gases, have found chemical engineers to be vital to their success. Chemical engineers are also important participants in pollution abatement, energy resources, national defense programs, and more recently in the manufacture of microelectronic devices and integrated circuits.

SPECIAL PROGRAMS AND OPPORTUNITIES

Co-op Program

The department, in conjunction with the P.C. Rossin College of Engineering and Applied Science, operates a cooperative program that is optional for specially selected students who are entering their junior year. This program offers early exposure to industry and an opportunity to integrate an academic background with significant periods of engineering practice. Our program is unique in offering two work experiences and still allowing the co-op students to graduate in four years with their class.

OSI Program

The Opportunities for Student Innovation (OSI) program seeks to develop students' propensities for critical assessment and innovative solution of meaningful problems. The OSI program offers selected seniors an opportunity to experience team research leading toward technological benefits. Some projects are hosted by industrial companies and carried out under the supervision of a Lehigh faculty members.

Minors and Specializations

Technical minors are available in biotechnology, energy engineering, computer science, environmental engineering, manufacturing systems, materials science and engineering, and polymer science and engineering. Minors are also available from the Business College and the College of Arts and Sciences.

Minor in Biotechnology

The department of Chemical and Biomolecular Engineering encourages engineering students to broaden their education by taking a minor. In this regard, a Biotechnology Minor is offered to students majoring in Engineering College. The Biotechnology minor requires 16 credit hours. A detailed listing of the required courses for the Biotechnology Minor can be obtained from the Chemical and Biomolecular Engineering Department.

Minor in Chemical Engineering

Minoring in Chemical Engineering provides students both bio-molecular and chemical engineering knowledge that they do not acquire in their major, such as knowledge of bio-chemical systems, transport phenomena, reaction engineering. This will widen their skills and help to increase the cooperation between the disciplines, which will lead to increased possibilities for employment. For further information please contact the department.

Concentrations

Chemical and Biomolecular Engineering offers five concentration areas, students majoring in Chemical Engineering can take three courses to have a certificate in a specific concentration. These courses may also be used to satisfy other elective requirements for their major.

Biomolecular Engineering

- **CHE/ BIOE 345** - Quantitative Biology (3 cr)
- **CHE 306** - Intro to Biomedical Engineering (3 cr)
- **CHE 321** - Biomolecular and Cellular mechanics (3 cr)
- **CHE/ BIOE 341** - Biotechnology I (3 cr)
- **CHE/ BIOE 342** - Biotechnology II (3 cr)
- **CHE/ BIOE 344** - Molecular Bioengineering (3 cr)
- **CHE 339** - Neuronal Modeling and Computation (3 cr)
- **CHE 396** - Engineering in Medicine (3 cr)
- **CHM 371** - Biochemistry I (3 cr)

Computational Methods in Engineering

- **CHE 339** - Neuronal Modeling and Computation (3 cr)
- **CHE 363** - Numerical Methods for Scientists and Engineers (3 cr)
- **CHE 365** - Molecular Modeling and Simulation (3 cr)
- **CHE 396** - Data Driven Modeling (2 cr)
- **CSE 002** - Fundamentals of Programming (2 cr)
- **CSE 017** - Programming and Data Structures (3 cr)
- **CSE 160** - Intro to Data Science (3 cr)
- **CSE 262** - Programming Languages (3 cr)
- **ISE 172** - Algorithms in System Engineering (4 cr)

Energy and Environment

- **CHE 376** - Energy: issues & technology (3 cr)
- **CHE 377** - Electrochemical Engineering (3 cr)
- **CEE 170** - Intro to Environmental Engineering (3 cr)
- **CHE/ CEE 373** - Fundamentals of Air Pollution (3 cr)
- **CHE/ CEE 375** - Environmental Engineering Processes (3 cr)
- **ME 360** - Nuclear Reaction Engineering (3 cr)
- **CHE 374** - Environmental Catalysis (3 cr)
- **CHE 398** - Advanced porous Material (3 cr)

Entrpreneurship

- **ENTP 101** - Introduction to Entrepreneurship (3 cr)
- **ENTP/ IR/ SDEB 307** - International Social Entrepreneurship (4 cr)
- Approved **Internship**
- Approved **Mountaintop Experience**
- Approved **Study Abroad**
- Approved **Research in the Department**

Polymer/ Functional Materials

- **CHE 392** - Introduction to Polymer Science (3 cr)
- **CHM (CHE) 391** - Colloid and Surface Chemistry (3 cr)
- **CHE 317** - Soft Materials: Rheology and Characterization (3 cr)
- **CHM 394** - Organic Polymer Science (3 cr)
- **MAT 204** - Processing and Properties of Polymeric Mats (3 cr)
- **MAT 386** - Polymer Nanocomposites (3 cr)
- **CHE (CHM) 393** - Physical Polymer Science (3 cr)
- **CHE 398** - Characteristics of Advanced Functional Materials (3 cr)

Overseas

Study abroad is available in exchange programs that have been established by the department for the junior year at the University of Nottingham (United Kingdom) and for the summer following the junior year at the University of Dortmund (Germany). Please visit http://www.aaa.tu-dortmund.de/cms/en/International_Students/International_Summer_Program__ISP_/index.html (http://www.aaa.tu-dortmund.de/cms/en/International_Students/International_Summer_Program__ISP_/)

Requirements of the Major

131 credit hours are required for graduation with the degree of bachelor of science in chemical engineering.

First Year

First Semester	Credits	Second Semester	Credits
WRT 001	3	WRT 002	3
MATH 021	4	MATH 022	4
ENGR 005	2	ENGR 010 or ECO 001	2-4
ENGR 010 or ECO 001	2-4	Select one of the following:	4-5
Select one of the following:	4-5	CHM 030 (4 CR)[1]	-
CHM 030 (4 CR)[1]	-	PHY 011 & PHY 012[1]	-
PHY 011 & PHY 012[1]	-		
	15-18		**13-16**

Second Year

First Semester	Credits	Second Semester	Credits
CHE 031	3	CHE 144	3
CHM 031	4	CHE 210	3
PHY 021 & PHY 022	5	MATH 205	3
MATH 023	4	Electives	7

CHE 179	1		
	17		**16**

Third Year

First Semester	Credits	Second Semester	Credits
CHE 151	3	CHE 244	3
CHE 201	4	CHE 211	3
CHM 110 & CHM 111	4	CHM 112	3
CHE 212	3	CHM 343	2
Electives	4	Electives	7
	18		**18**

Fourth Year

First Semester	Credits	Second Semester	Credits
CHE 202	3	CHE 203	3
CHE 233	3	CHE 234	3
CHE 242	3	Electives	11
Electives	6		
	15		**17**

Total Credits: 129-135

1

Required natural science courses, one taken fall semester and the other taken in spring

There are six types of electives:

1. Humanities/Social Sciences: See the requirements (p. 400) set by the P.C. Rossin College of Engineering and Applied Science. Note that ECO 001 is required, as well as Freshman English.
2. Bio-Elective: Students must have AP BIOS credits or must pick one from BIOS 041, BIOE 321, BIOE 349, CHE 341, CHE 345, or CHM 371.
3. Three credit hours from approved courses in other engineering departments (BioE, CEE, CSE, ECE, ISE, MEM, MSE).
4. Chemical and Biomolecular Engineering: CHE 001 or 3 credit hours of CHE 300-level or higher.
5. Chemical and Biomolecular Engineering OR Chemistry: 3 credit hours of CHM 300-level or higher OR 3 credit hours of CHE 300-level or higher.
6. Chemical and Biomolecular Engineering:: 3 credit hours of CHE 300 level or higher.
7. Free electives: 6 credit hours in any subject area.

Electives in (2) to (6) above can be combined with any technical minor in RCEAS.

GRADUATE PROGRAMS

The Department of Chemical and Biomolecular Engineering offers graduate programs leading to the master of science, master of engineering, and doctor of philosophy degrees in Chemical Engineering and master of engineering degree in Chemical Engineering, Biological Chemical Engineering and Chemical Energy Engineering. The programs are all custom tailored for individual student needs and professional goals. These individual programs are made possible by a diversity of faculty interests that are broadened and reinforced by cooperation between the department and several research centers on the campus.

A free flow of personnel and ideas between the centers and academic departments ensures that the student will have the widest choice of research activities. The student is also exposed to a wide range of ideas and information through courses and seminars to which both faculty and center personnel contribute. In addition, strong relationships with industry are maintained by the department and the research centers, some of which operate industrially-sponsored liaison programs whereby fundamental non-proprietary research is performed in areas of specific interest to participating sponsors.

In addition to interacting with the centers, the department originates and encourages programs that range from those that are classical chemical engineering to those that are distinctly interdisciplinary. The department offers active and growing programs in adhesion and tribology; emulsion polymerization and latex technology; bulk polymer systems; process control; process improvement studies; rheology; computer applications; environmental engineering; thermodynamics; kinetics and catalysis; enzyme technology; data science; and biochemical engineering.

Career Opportunities

Master of science, master of engineering, and doctor of philosophy graduates in the chemical engineering area are sought by industry for activities in the more technical aspects of their operations, especially design, process and product development, and research. Many of these graduates also find opportunities in research or project work in government agencies and in university teaching and research.

Physical Facilities

The department is well equipped for research in bioengineering, nanotechnology, energy, colloids and surface science, adhesion and tribology, polymer science and engineering, catalysis and reaction kinetics, thermodynamic property studies, fluid dynamics, heat and mass transfer, process dynamics and control, and enzyme engineering and biochemical engineering.

The departmental and university computing facilities include PCs and workstations, connected by a university-wide high speed network, which in turn provides worldwide networking via the Internet.

All of these facilities can access a wide variety of general purpose, and scientific and engineering software via the university and local networks, including software specifically for the steady state and dynamic simulation of chemical engineering systems.

Special Programs

Polymer Science and Engineering. The polymers activity includes work done in the Department of Chemical and Biomolecular Engineering as well as the Departments of Chemistry, Materials Science, and Physics, the Materials Research Center, the Center for Polymer Science and Engineering, and the Emulsion Polymers Institute. More than 20 faculty members from these organizations or areas have major interests in polymers and cooperate on a wide range of research projects. For students with deep interest in the area, degree programs are available leading to the master of science, master of engineering, and doctor of philosophy degrees in polymer science and engineering.

Distance Education

Delivered online through the Office of Distance Education, these programs are convenient for the part-time student and courses are the same level of quality of instruction that is available to our on-campus students. Choose from the following engineering programs; Master of Engineering degree in Chemical Engineering, Biological Chemical Engineering, Chemical Energy Engineering and Certificate in Chemical and Biomolecular Engineering. To learn more, visit the Office of Distance Education Online Programs (https://distance.lehigh.edu/online-programs/).

Major Requirements

All Ph.D. students must complete eight courses in consultation with his/her committee, although CHE 400, CHE 410, CHE 415 and CHE 452 are required. In addition to approved courses, all Ph.D. students must pass a qualification examination given during the second year of residence.

Candidates for Master of Science degree are required to complete 30 credits hours of course work which must include CHE 400, CHE 410, CHE 415 and CHE 452, and a research report or thesis for which six hours of graduate credits are earned.

Candidates for the Master of Engineering degrees do not do research; all 30 credit hours are fulfilled by course work. Course selection is done individually for each student within the University requirements for a master's degree.

The requirements for each of the Master degrees is slightly different. For more information on all of our Master degrees, please visit the Graduate Chemical and Biomolecular Engineering page at

https://engineering.lehigh.edu/chbe/graduate (http://www.lehigh.edu/~incheme/stu_graduate_thesis_progreq.html)

Courses

CHE 001 Coffee and Cosmetics 3 Credits
This course will focus on developing processes for creating coffee and cosmetics that overlap with core principles of chemical engineering. Coffee will introduce students to basic concepts of process design and scale-up and the ideas of "unit operations" that that are performed such as roasting, grinding, and filtration. Cosmetics will introduce the basic principles of rheology, surface energy, and other concepts that surround "squishy" materials. These everyday goods will bring new light to the interface of engineering and consumer products.

CHE 031 Material and Energy Balances of Chemical Processes 0,3 Credits
Material and energy balances with and without chemical reaction. Introduction to phase equilibrium calculations. Applications in chemical process calculations and in design of staged separations: binary distillation, liquid-liquid extraction.
Prerequisites: ENGR 010 and (CHM 030 or CHM 040)
Can be taken Concurrently: ENGR 010, CHM 030, CHM 040

CHE 044 Fluid Mechanics 0,3 Credits
Fluid mechanics and its applications to chemical processes. Momentum and energy balances in fluid flow. Dimensional analysis. Fluid flow in pipes, packed and fluidized beds. Mixing and agitation. Filtration and sedimentation.

CHE 085 Undergraduate Research 1 Credit
Independent study of a problem involving laboratory investigation, design, or theoretical studies under the guidance of a faculty. Consent of the department chair.
Repeat Status: Course may be repeated.

CHE 144 Fluid Mechanics 3 Credits
Fluid mechanics and its applications to chemical processes. Momentum and energy balances in fluid flow. Dimensional analysis. Fluid flow in pipes, packed and fluidized beds. Mixing and agitation. Filtration and sedimentation. Credit will not be granted for both CHE 044 and CHE 144.

CHE 151 Heat and Mass Transfer 0,3 Credits
Fundamental principles of heat and mass transfer. The three modes of heat transfer are taught: conduction, convection and radiation. The physical principles of mass transfer are taught including diffusion and convection. Parallels and relationships between heat and mass transfer are highlighted. Fundamental principles of heat and mass transfer are applied to the analysis and design of unit operations including heat exchangers and mass separators.
Prerequisites: CHE 031 and CHE 044 and CHE 210

CHE 171 (CEE 171, EMC 171) Fundamentals of Environmental Technology 4 Credits
Introduction to water and air quality, water, air and soil pollution. Chemistry of common pollutants. Technologies for water purification, wastewater treatment, solid and hazardous waste management, environmental remediation, and air quality control. Global changes, energy and environment. Constraints of environmental protection on technology development and applications. Constraints of economic development on environmental quality. Environmental life cycle analysis and environmental policy. Not available to students in RCEAS.

CHE 179 Professional Development 1 Credit
Elements of professional growth, registration, ethics, and the responsibilities of engineers both as employees and as independent practitioners. Proprietary information and its handling. Patents and their importance. Discussions with the staff and with visiting Lecturers. A few plant trips.

CHE 185 Undergraduate Research I 1-3 Credits
Independent study of a problem involving laboratory investigation, design, or theoretical studies under the guidance of a faculty member.
Repeat Status: Course may be repeated.

CHE 186 Undergraduate Research II 1-3 Credits
A continuation of the project begun under CHE 185. Consent of department chair.
Repeat Status: Course may be repeated.
Prerequisites: CHE 185

CHE 201 Methods of Analysis in Chemical Engineering 0,4 Credits
Analytical and numerical methods of solution applied to dynamic, discrete and continuous chemical engineering processes. Laplace Transforms. MATLAB based computations. Methods of analysis applied to equilibrium, characteristic value and non-linear chemical engineering problems.
Prerequisites: CHE 044 and CHE 210 and MATH 023 and MATH 205
Can be taken Concurrently: MATH 205

CHE 202 Chemical and Biomolecular Engineering Laboratory I 0,3 Credits
The laboratory study of chemical engineering unit operations and the reporting of technical results. One three-hour laboratory and one lecture period per week. Independent study and both group and individual reporting.
Prerequisites: CHE 151 and CHE 211 and CHE 244

CHE 203 Chemical and Biomolecular Engineering Laboratory II 3 Credits
Laboratory experience with more complex chemical processing situations including processes involving chemical reactions and those controlled automatically.
Prerequisites: CHE 202

CHE 210 Chemical Engineering Thermodynamics 0,3 Credits
Energy relations and their application to chemical engineering. Consideration of flow and nonflow processes. Evaluation of the effects of temperature and pressure on the thermodynamic properties of fluids. Heat effects accompanying phase changes and chemical reactions. Determination of chemical and physical equilibrium.
Prerequisites: CHE 031 and MATH 023

CHE 211 Chemical Reactor Design 0,3 Credits
The theory of chemical kinetics to the design and operation of chemical reactors. Plug flow and continuous stirred tank reactors. Homogeneous and heterogeneous reaction kinetics. Design of isothermal and adiabatic reactors.
Prerequisites: CHE 210

CHE 212 Physical Chemistry for Engineers 0,3 Credits
Thermodynamics of phase and reaction equilibria. Quantum theory and molecular spectroscopy. Reaction kinetics in homogeneous and heterogeneous systems. Fundamentals of Electrochemistry. Physical chemistry of colloidal systems.
Prerequisites: CHE 210 or ME 104

CHE 231 Biomolecular Engineering 3 Credits
Application of quantitative chemical engineering concepts to biological systems. Topics include kinetic and thermodynamic contributions to protein-ligand binding, enzyme kinetics, gene expression, protein trafficking, and cell growth.
Prerequisites: CHE 031 and (CHE 210 or BIOE 246 or MAT 205 or ME 104)

CHE 233 Process Design I 0,3 Credits
Design of chemical plants incorporating traditional elements of engineering economics and synthesis of steady-state flowsheets with (1) both heuristic and rigorous optimization methods and (2) consideration of dynamic controllability of the process. Economic principles involved in the selection of process alternatives and determination of process capital, operating costs, and venture profitability. Energy conservation, pinch techniques, heat exchanger networks, and separation sequences. Considerations of market limitations, environmental and regulatory restrictions, and process safety. Use of modern computer aided software for steady-state and dynamic simulation and optimization. Group design projects.
Prerequisites: (CHE 211 and CHE 242 and CHE 244)
Can be taken Concurrently: CHE 242

CHE 234 Process Design II 0,3 Credits
Continuation of CHE 233.
Prerequisites: CHE 233
Can be taken Concurrently: CHE 233

CHE 242 Introduction to Process Control and Simulation 0,3 Credits
Dynamic simulation of chemical processes. Transfer functions and block diagrams. Introduction to process control equipment. Open-loop and closed-loop stability analysis using root locus and Nyquist techniques. Design of control systems.
Prerequisites: CHE 201 and CHE 151 and ENGR 010

CHE 244 Separation Processes 0,3 Credits
Staged and continuous separations. Phase equilibrium. Binary and Multicomponent Distillation. Liquid-liquid extraction. Review of applied diffusion processes, atmospheric dispersion, jets and plumes. Membranes in gas and liquid systems. Adsorption and Ion Exchange Separations. Chromatographic Separations. Introduction to Bioseparations. Introduction to Aspen Programming.
Prerequisites: CHE 031 and CHE 044 and CHE 210 and CHE 151

CHE 280 Unit Operations Survey 3 Credits
The theory of heat, mass and momentum transport. Laminar and turbulent flow of real fluids. Heat transfer by conduction, convection and radiation. Application to a wide range of operations in the chemical and metallurgical process industries.

CHE 281 Chemical Engineering Fundamentals I 4 Credits
Fundamentals of material balances, fluid mechanics and heat transfer. Must have undergraduate degree in a scientific or engineering discipline or one semester undergraduate level general chemistry, one semester undergraduate level physics (statics and dynamics), and two semesters undergraduate calculus. Consent of department required.

CHE 282 Chemical Engineering Fundamentals II 4 Credits
Fundamentals of heat and mass transfer, process energy balances and unit operations. Consent of department required.
Prerequisites: CHE 281

CHE 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

CHE 306 Introduction to Biomedical Engineering and Mathematical Biology 3 Credits
Study of human physiology, including the cardiovascular, nervous and respiratory systems, and renal physiology. Mathematical analysis of physiological processes, including transport phenomena. Mathematical models of excitation and propagation in nerve. Biomechanics of the skeletal muscle system. Mathematical models in population dynamics and epidemiology. Independent study projects.
Prerequisites: MATH 205

CHE 318 (BIOE 318, MAT 318) Soft Materials: Rheology and Characterization 3 Credits
Characterization of soft materials using rheological techniques. Fundamentals of rheology and rheological characterization applied to materials such as polymers, glassy liquids and polymeric gels. Closed to students who have taken CHE/BIOE/MAT 418. Instructor permission or graduate status required.

CHE 321 Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of the components of the cell, ranging in length scale from fundamental biomolecules to the entire cell. Thecourse covers the mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell.
Prerequisites: MATH 205 and MATH 231 and PHY 022 and (PHY 013 or PHY 021)

CHE 331 Separation Processes 3 Credits
Industrial separation chemistry and processes. Computer solutions for simple and complex multicomponent distillation columns. Azeotropic and extractive distillation. Adsorption, ion exchange and chromatography in packed beds, moving beds and cyclic operation. Synthesis of polymer membrane and its applications to industrial separation processes.

CHE 334 (MAT 334) Electron Microscopy and Microanalysis 4 Credits
Fundamentals and experimental methods in electron optical techniques including scanning electron microscopy (SEM), conventional transmission (TEM) and scanning transmission (STEM) electron microscopy. Specific topics covered will include electron optics, electron beam interactions with solids, electron diffraction and chemical microanalysis. Applications to the study of the structure of materials are given. Consent of department required.

CHE 339 Neuronal Modeling and Computation 3 Credits
Neuroscience in a computational, mathematical, and engineering framework. Literature surveys and case studies with simulations. Computational aspects of information processing within the nervous system by focusing on single neuron modeling. Single neurons and how their biological properties relate to neuronal coding. Biophysics of single neurons, signal detection and signal reconstruction, information theory, population coding and temporal coding.
Prerequisites: ENGR 010 and MATH 205

CHE 341 (BIOE 341) Biotechnology I 3 Credits
Applications of material and energy balances; heat, mass, and momentum transfer; enzyme and microbial kinetics; and mathematical modeling to the engineering design and scale-up of bio-reactor systems. Closed to students who have taken CHE 441 (BIOE 341 and BIOE 441).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

CHE 342 (BIOE 342) Biotechnology II 3 Credits
Engineering design and analysis of the unit operations used in the recovery and purification of products manufactured by the biotechnology industries. Requirements for product finishing and waste handling will be addressed. Closed to students who have taken CHE 442 (BIOE 342 and BIOE 442).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

CHE 344 (BIOE 344) Molecular Bioengineering 3 Credits
Kinetics in small systems, stochastic simulation of biochemical processes, receptor-mediated adhesion, dynamics of ion-channels, ligand binding, biochemical transport, surface Plasmon resonance, DNA microarray design, and chemical approaches to systems biology. Senior standing in ChE.
Prerequisites: MATH 205 and MATH 231

CHE 345 (BIOE 345) Quantitative Biology 3 Credits
Basic concepts in molecular and cellular biology as well as biochemistry. Connects these to engineering principles to (1) develop a quantitative understanding of biological systems and (2) understand how modern engineering uses applications of methods and principles in biology. Topics include quantity and length scales in biology, use of statistical mechanics to describe phenomena such as microstates and ligand receptor binding, and application of chemical reaction kinetics to describe biochemical reactions. Closed to students who have taken BIOE 445.
Prerequisites: MATH 205

CHE 346 Biochemical Engineering Laboratory 0,3 Credits
Laboratory and pilot-scale experiments in fermentation and enzyme technology, tissue culture, and separations techniques. Consent of instructor required. Closed to students who have taken CHE 446.
Prerequisites: CHE 341
Can be taken Concurrently: CHE 341

CHE 350 Special Topics 1-3 Credits
A study of areas in chemical engineering not covered in courses presently listed in the catalog.
Repeat Status: Course may be repeated.

CHE 363 (BIOE 363) Numerical Methods for Scientists and Engineers 3 Credits
Introduction to numerical methods in science and engineering. Expose students to the numerical solution of a variety of commonly encountered problems, enhance their numerical programming skills, and provide a broad base on which to build more specialized knowledge of computational methods. Topics include solution of linear and nonlinear sets of algebraic equations, linear and logistic regression, ordinary differential equations, Fourier analysis, eigenvalues, partial differential equations by finite difference and finite element methods.
Prerequisites: MATH 205

CHE 365 Molecular Modeling and Simulation 3 Credits
Introduction to molecular modeling and simulation techniques. Expose students to programming environments and give a broad overview of molecular simulation methods used in chemical engineering. Topics include density functional theory including periodic systems, molecular dynamics, Monte Carlo techniques, review of statistical mechanics and ensembles, biased sampling and free energy methods, and microkinetic modeling. Student will use existing software as well as develop their own computer codes in this class.

CHE 367 (BIOE 367) Engineering in Medicine 3 Credits
Introduction to the physical basis of disease. Discussion of biomolecular strategies to overcome these changes. Topics include drug delivery, targeting, and tissue engineering, with a focus on infectious disease, cancer, cardiovascular disease, and neurodegenerative disease. Closed to students who have taken CHE 467 (BIOE 367 and BIOE 467).

CHE 369 (BIOE 369) Advanced Topics in Regulatory Affairs 3 Credits
Regulatory requirements for the development and manufacture of 21st century medical products. Current challenges and innovative technologies in pharmaceuticals and medical devices. Topics include combination products, biosimilars, cell therapeutics, mobile medical applications, 3D-printed products, big data in healthcare, new approaches to process validation. Closed to students who have taken BIOE/CHE 469.
Prerequisites: BIOE 225

CHE 370 (BIOE 370) The Engineering of Brewing, Winemaking, and Distilling 0,3 Credits
An open-ended and experiential exploration of the engineering principles required for the brewing of beer, winemaking, and distilling of spirits.
Prerequisites: (BIOE 341 or CHE 211) and (BIOE 246 or CHE 212)

CHE 373 (CEE 373) Fundamentals of Air Pollution 3 Credits
Introduction to the problems of air pollution including such topics as: sources and dispersion of pollutants; sampling and analysis; technology of economics and control processes; legislation and standards. Must have senior standing in the College of Engineering and Applied Science.

CHE 374 Environmental Catalysis 3 Credits
Pollution emissions in the USA (NOx, SOx, NH3, CO, VOCs, PM, heavy metals and persistent bioaccumulative chemicals) and their sources and fate. Fundamental concepts of catalysis (surface and their characterization, physical adsorption, surface reaction mechanisms and their kinetics). Application of catalysis to a wide range of environmental issues (catalytic combustion of VOCs, automotive catalytic converter, selective catalytic conversion of NOx, etc.) Must have senior standing. Consent of instructor required.

CHE 375 (CEE 375) Environmental Engineering Processes 3 Credits
Fundamental physical, chemical and microbiological processes applied in environmental engineering for air pollution control, treatment of drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Kinetics, reactor theory, mass balances, application of fundamental physical, chemical and microbiological principles to analysis and design.
Prerequisites: CEE 170 and CHM 031

CHE 376 (ME 376) Energy: Issues & Technology 3 Credits
Energy usage and supply, fossil fuel technologies, renewable energy alternatives and environmental impacts. The scope will be broad to give some perspective of the problems, but in-depth technical analysis of many aspects will also be developed.
Prerequisites: CHE 210 or ME 104 or CHM 342 or MAT 205

CHE 377 Electrochemical Engineering 3 Credits
Fundamental concepts of electrochemistry, covering the thermodynamics, kinetics, and transport phenomena that occur in both liquid and solid state electrochemical systems. This course draws upon concepts from physical chemistry, chemical engineering and materials science to address the phenomena that govern the performance of electrochemical devices, and that drive important engineering phenomena such as corrosion. The course will serve as a basis for a career in electrochemistry as it applies to energy issues. Prerequisites: Senior level in ChE or instructor approval.

CHE 379 Senior Thesis 3 Credits
Two-semester, independent study of a research problem under the guidance of a faculty advisor and thesis committee. Written thesis proposal and oral presentation required in first semester, and a written final thesis and oral presentation required at the end of the second semester. Students will receive a certificate upon graduation with the thesis title, signed by the advisor and department chair. Must have senior standing in Chemical and Biomolecular Engineering. Consent of department required.
Repeat Status: Course may be repeated.

CHE 380 Senior Research Project (OSI) 1-6 Credits
Independent study of a problem involving laboratory investigation, design, and theory, when possible involves one of the local communities or industries. Team work under the guidance of Faculty advisors. Experiential learning opportunity to bridge educational gap between conventional textbook learning and industrial approaches to real-world technical problem solving. Must have senior standing. Consent of department required.
Repeat Status: Course may be repeated.

CHE 383 Chemical Engineering Fundamentals III 4 Credits
Fundamentals of thermodynamics, reaction kinetics and reactor analysis, and applied mathematics. Consent of department required. Cannot apply towards a Chemical Engineering undergraduate degree.
Prerequisites: CHE 282

CHE 386 Process Control 3 Credits
Open-loop and closed-loop stability analysis using root locus and Nyquist techniques, design of feedback controllers with time and frequency domain specifications. Experimental process identification. Control of multivariable processes. Introduction to sampled-data control theory.
Prerequisites: CHE 242

CHE 387 (ECE 387, ME 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane; root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Liapunov stability state feedback control (2 lectures and one laboratory per week).
Prerequisites: CHE 386 or ECE 212 or ME 343

CHE 388 (CHM 388, MAT 388) Polymer Characterization 3 Credits
Description of molecular weight measurements using dilute solutions (solution viscosity, size exclusion chromatography, osmotic pressure, and light scattering). Introduction to polymer thermal analysis techniques such as differential scanning calorimetry (DSC) , dynamic mechanical analysis (DMA), and thermomechanical analyzer (TMA). Discussion of structure and morphology of polymers and polymer blends using nuclear magnetic resonance (NMR), infrared spectroscopy (IR), Raman spectroscopy, UV analysis, transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM). Crystallinity measurements using SANS, SAXS, and WAXS.
Prerequisites: MAT 033 or MAT 204 or MAT 392 or MAT 393

CHE 389 (ECE 389, ME 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state-of-the-art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary.
Prerequisites: CHE 242 or ECE 212 or ME 343

CHE 391 (CHM 391) Colloid and Surface Chemistry 3 Credits
Physical chemistry of everyday phenomena. Intermolecular forces and electrostatic phenomena at interfaces, boundary tensions and films at interfaces, mass and charge transport in colloidal suspensions, electrostatic and London forces in disperse systems, gas adsorption and heterogeneous catalysis. Consent of instructor required.

CHE 392 (MAT 392) Introduction to Polymer Science 3 Credits
Introduction to concepts of polymer science. Kinetics and mechanism of polymerization, synthesis and processing of polymers, characterization. Relationship of molecular conformation, structure and morphology to physical and mechanical properties.

CHE 393 (CHM 393, MAT 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single- and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT.

CHE 394 (CHM 394) Organic Polymer Science I 3 Credits
Organic chemistry of synthetic high polymers. Polymer nomenclature, properties, and applications. Functionality and reactivity or monomers and polymers. Mechanism and kinetics of step-growth and chain-growth polymerization in homogenous and heterogenous media. Brief description of emulsion polymerization, ionic polymerization, and copolymerization. Must have completed one year of physical chemistry and one year of organic chemistry.
Prerequisites: CHM 031 or CHM 041 or CHM 110 or CHM 112 or CHM 342 or CHE 210
Attribute/Distribution: NS, Q

CHE 400 Chemical Engineering Thermodynamics 3 Credits
Applications of thermodynamics in chemical engineering. Topics include energy and entropy, heat effects accompanying solution, flow of compressible fluids, refrigeration including solution cycles, vaporization and condensation processes, and chemical equilibria. Must have completed an introductory course in thermodynamics.

CHE 401 Chemical Engineering Thermodynamics II 3 Credits
A detailed study of the uses of thermodynamics in predicting phase equilibria in solid, liquid, and gaseous systems. Fugacities of gas mixtures, liquid mixtures, and solids. Solution theories; uses of equations of state; high-pressure equilibria.

CHE 410 Chemical Reaction Engineering 3 Credits
The application of chemical kinetics to the engineering design and operation of reactors. Non-isothermal and adiabatic reactions. Homogeneous and heterogeneous catalysis. Residence time distribution in reactors.

CHE 413 Heterogeneous Catalysis and Surface Characterization 3 Credits
History and concepts of heterogeneous catalysis. Surface characterization techniques, and atomic structure of surfaces and adsorbed monolayers. Kinetics of elementary steps (adsorption, desorption, and surface reaction) and overall reactions. Catalysis by metals, metal oxides, and sulfides. Industrial applications of catalysis: selective oxidation, pollution control, ammonia synthesis, hydrogenation of carbon monoxide to synthetic fuels and chemicals, polymerization, hydrotreating, and cracking.

CHE 415 Transport Processes 3 Credits
A combined study of the fundamentals of momentum transport, energy transport and mass transport and the analogies between them. Evaluation of transport coefficients for single and multicomponent systems. Analysis of transport phenomena through the equations of continuity, motion, and energy.
Prerequisites: CHE 461 or ENGR 452 or CHE 452

CHE 417 (BIOE 417, MAT 417) Soft Materials: Mechanics and Physics 3 Credits
Physical and mechanical behavior of soft materials such as gels, foams, rubbers, soft adhesives, and most biological tissue. Large strain kinematics, stress measures, constitutive relations from the molecular and continuum points of view, and application to problems such as cavitation, creasing, thin structures, fracture, adhesion, surface stress, and electroactive materials.
Prerequisites: CHE 452 or ENGR 452

CHE 418 (BIOE 418, MAT 418) Soft Materials: Rheology and Characterization 3 Credits
See the course description listed for CHE/BIOE/MAT 318. In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE/BIOE/MAT 318.

CHE 421 (BIOE 421) Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of cell components, from fundamental biomolecules to the entire cell. The mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell. This course is a graduate version of ChE 321 (BioE/Phy 321). The lecture content will be the same as in ChE 321 (BioE/Phy 321), but students enrolled in ChE 421 (BioE 421) will have more advanced assignments. Closed to students who have completed ChE 321 (BioE/Phy 321). Must have graduate standing or consent of instructor.

CHE 428 Rheology 3 Credits
An intensive study of momentum transfer in elastic viscous liquids. Rheological behavior of solution and bulk phase polymers with emphasis on the effect of molecular weight, molecular weight distribution and branching. Derivation of constitutive equations based on both molecular theories and continuum mechanics principles. Application of the momentum equation and selected constitutive equations to geometries associated with viscometric flows. Consent of instructor required.
Prerequisites: CHE 461 or CHE 452

CHE 430 Mass Transfer 3 Credits
Theory and developments of the basic diffusion and mass transfer equations and transfer coefficients including simultaneous heat and mass transfer, chemical reaction and dispersion effects. Applications to various industrially important operations including continuous contact mass transfer, absorption, humidification, etc. Brief coverage of equilibrium stage operations as applied to absorption and to binary and multicomponent distillation.

CHE 433 (ECE 433, ME 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations, Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability, Canonical forms, minimal realizations, introduction to optimal control theory, Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers.
Prerequisites: CHE 386 or ME 343 or ECE 212

CHE 434 (ECE 434, ME 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special attention is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures.
Prerequisites: CHE 433 or ME 433 or ECE 433

CHE 436 (ECE 436, ME 436) Systems Identification 3 Credits
The determination of model parameters from time history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant-imbedding techniques for nonlinear system parameter identification included.

CHE 438 Process Modeling and Control Seminar 1 Credit
Presentations and discussions on current methods, approaches, and applications. Credit cannot be used for the M.S. degree.

CHE 439 (BIOE 439) Neuronal Modeling and Computation 3 Credits
This course is a graduate version of CHE 339 (BIOE 339). While the lecture content will be the same as the 300-level course, students in the 400-level class will be expected to complete an independent term project. Closed to students who have completed CHE 339 (BIOE 339). Must have graduate standing in Chemical Engineering or Bioengineering.

CHE 440 Chemical Engineering in the Life Sciences 3 Credits
Introduction of important topics in life sciences to chemical engineers. Topics include protein and biomolecule structures and characterization, recombinant DNA technology, immunoaffinity technology, combinatorial chemistry, metabolic engineering, bioinformatics. Must have Bachelor's degree in science or engineering.

CHE 441 (BIOE 441) Biotechnology I 3 Credits
See the course description listed for CHE 341 (BIOE 341). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 341 (BIOE 341).

CHE 442 (BIOE 442) Biotechnology II 3 Credits
See the course description listed for CHE 342 (BIOE 342). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 342 (BIOE 342).

CHE 444 Bioseparations 3 Credits
Separation techniques for biomolecule isolation and purification. Theory and problems of bioaffinity chromatography, electromigration processes, and aqueous two-phase polymer extraction systems. Engineering principles for scaling-up bioseparation processes. Consent of instructor required.

CHE 445 (BIOE 445) Quantitative Biology 3 Credits
This course is a graduate-level version of BIOE 345. While the lecture content will be the same as the 300-level course, students enrolled in BIOE 445 will have more advanced assignments. Closed to students who have taken BIOE 345.

CHE 446 Biochemical Engineering Laboratory 0,3 Credits
Laboratory and pilot-scale experiments in fermentation and enzyme technology, tissue culture, and separations techniques. Closed to students who have taken CHE 346.
Prerequisites: CHE 341 or CHE 444 or CHE 342
Can be taken Concurrently: CHE 342

CHE 447 (BIOE 447) Molecular Bioengineering 3 Credits
This course is a graduate version of CHE 344 (BIOE 344). While the lecture content will be the same as the 300-level course, students enrolled in CHE 444 will have more advanced assignments. Closed to students who have completed CHE 344 (BIOE 344).

CHE 448 Topics in Biochemical Engineering 3 Credits
Analysis, discussion, and review of current literature for a topical area of biotechnology. may be repeated for credit with the consent of the instructor. Consent of instructor required.
Repeat Status: Course may be repeated.

CHE 449 (BIOE 449) Metabolic Engineering 3 Credits
Quantitative perspective of cellular metabolism and biochemical pathways. Methods for analyzing stoichiometric and kinetic models, mass balances, flux in reaction networks, and metabolic control. Solving problems using advanced mathematics and computer programming. Closed to students who have completed BIOE 349. Must have graduate standing in Chemical Engineering or Bioengineering.

CHE 450 Special Topics 1-12 Credits
An intensive study of some field of chemical engineering not covered in the more general courses. Credit above three hours is granted only when different material is covered.

CHE 451 Problems In Research 1 Credit
Study and discussion of optimal planning of experiments and analysis of experimental data. Discussion of more common and more difficult techniques in the execution of chemical engineering research.

CHE 452 (BIOE 452, ENGR 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non- diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

CHE 453 Teaching Apprentice 1 Credit
Students will work under the guidance of individual Faculty instructors to participate in some of the following teaching tasks: Development of the course syllabus, preparation and grading of homework and exams, holding a recitation and/or lecture section. Must have graduate standing in ChE department.
Repeat Status: Course may be repeated.

CHE 454 Seminar 0-3 Credits
Critical discussion of recent advances in chemical engineering.

CHE 455 Seminar 1-3 Credits
Critical discussion of recent advances in chemical engineering. Credit above one hour is granted only when different material is covered.

CHE 456 (BIOE 456) Stochastic Processes: Theory and Applications in Biology 3 Credits
Stochastic, or probabilistic, models of cellular processes and other biological systems to describe the inherent randomness of nature. Topics covered include theory and biological applications of Markov chains, the Master Equation, white noise and stochastic integrals, the Fokker-Planck Equation, and noise in gene expression. Some minimal experience in programming and/or Mathematica/Matlab.
Prerequisites: MATH 205

CHE 460 Chemical Engineering Project 1-6 Credits
An intensive study of one or more areas of chemical engineering, with emphasis on engineering design and applications. A written report is required.
Repeat Status: Course may be repeated.

CHE 463 (BIOE 463) Numerical Methods for Scientists and Engineers 3 Credits
See the course description listed for ChE 363 (BIOE 363). This course is graduate version of ChE 363 (BIOE 363). The lecture content will be the same as ChE 363 (BIOE 363), but students enrolled in ChE 463 (BIOE 463) will have more advanced assignments. Closed to students who have taken ChE 363 (BIOE 363). Must have graduate standing or consent of the instructor.

CHE 465 Molecular Modeling and Simulation 3 Credits
See the course description listed for ChE 365. This course is graduate version of ChE 365. The lecture content will be the same as ChE 365, but students enrolled in ChE 465 will have more advanced assignments. Closed to students who have taken ChE 365. Must have graduate standing or consent of the instructor.

CHE 467 (BIOE 467) Engineering in Medicine 3 Credits
See the course description listed for CHE 367 (BIOE 367). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 367 (BIOE 367), or BIOE 467.

CHE 469 (BIOE 469) Advanced Topics in Regulatory Affairs 3 Credits
This course is a graduate version of BIOE 369 (CHE 369). While the lecture content will be the same as the 300-level course, students enrolled in BIOE 469 (CHE 469) will have more advanced assignments. Closed to students who have taken BIOE/CHE 369.

CHE 473 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes.
Prerequisites: CEE 470

CHE 480 Research 3 Credits
Investigation of a problem in chemical engineering.

CHE 481 Research 3 Credits
Continuation of CHE 480.

CHE 482 (CHM 482, MAT 482) Mechanical Behaviors of Polymers 3 Credits
Mechanical behavior of polymers. Characterization of viscoelastic response with the aid of mechanical model analogs. Time-temperature superposition, experimental characterization of large deformation, and fracture processes, polymer adhesion. Effects of fillers, plasticizers, moisture, and aging on mechanical behavior.

CHE 483 (CHM 483, MAT 483) Emulsion Polymers 3 Credits
Examination of fundamental concepts important in the manufacture, characterization, and application of polymer latexes. Topics to be covered will include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

CHE 485 (CHM 485, MAT 485) Polymer Blends 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends. Polymer/polymer miscibility and thermodynamics of mixing of polymer/solvent and polymer/polymer blends. Prediction of miscibility using various theoretical models and methods that can be used to help enhance miscibility (H bonding etc.). Methods to enhance the compatibility of polymer/polymer blends (e.g., block copolymers, ternary addition, IPNs), etc.). Types of polymer blends. Must have completed any introductory polymer course or equivalent.

CHE 486 Polymer Processing 3 Credits
Application of fundamental principles of mechanics, fluid dynamics and heat transfer to the analysis of a wide variety of polymer flow processes. A brief survey of the rheological behavior of polymers is also included. Topics include pressurization, pumping, die forming, calendering, coating, molding, fiber spinning and elastic phenomena.

CHE 490 Thesis 1-6 Credits

CHE 492 (CHM 492, MAT 492) Topics in Polymer Science 3 Credits
Intensive study of topic selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtonian flow behavior, second order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.
Prerequisites: CHE 392 or CHE 392 or CHM 392 or CHM 392

CHE 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Civil and Environmental Engineering

CIVIL ENGINEERING

Civil engineering occupies a prominent position as one of the major fields in the engineering profession. Civil engineers are concerned with all aspects of the conception, planning, design, construction, operation, and maintenance of major physical works and facilities that are essential to modern life. Civil engineering projects are typically characterized by extreme size, complexity, durability, and cost. Examples include bridges, buildings, transportation facilities, tunnels, coastal facilities, dams, foundations, and waterways.

The **Mission** of our Civil Engineering Bachelor of Science degree program is to educate students in the principles and methods essential to the practice and advancement of the interdisciplinary field of civil engineering. The program is proactive and continues to incorporate new and emerging paradigms in all aspects of teaching and education while maintaining rigorous standards in traditional approaches to engineered solutions of civil problems. Our goal is to prepare students to apply and continually cultivate knowledge that will enable them to become successful practitioners, innovators and leaders in serving the needs of a complex society.

The **Program Educational Objectives** of our Civil Engineering Bachelor of Science program are to prepare Civil Engineering Graduates to :

1. Develop careers in civil engineering and other professionally related fields.
2. Seek additional professional training and personal development.
3. Apply their skills to develop innovative solutions and technologies.
4. Pursue professional licensure and/or certification.
5. Advance to become members of professional societies and future leaders in their profession.

To achieve the program education objectives, the civil engineering program has adopted the following seven ABET student outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

ENVIRONMENTAL ENGINEERING

Environmental Engineering is an interdisciplinary branch of the engineering profession where science and engineering principles are combined to provide healthy soil, water and air; remediate contaminated sites; and to improve the overall quality of the environment through the development of sustainable processes. Example activities include design of water and wastewater treatment facilities; detecting and modeling fate and transport of contaminants in both natural and engineered environments; developing technology-based solutions for restoring environmental quality; and developing and/or modifying industrial processes for ecological preservation and enhanced sustainability.

The **Mission** of our Environmental Engineering Bachelor of Science degree program is to educate students in the principles and methods essential to the practice and advancement of the interdisciplinary field of environmental engineering. The program is proactive and continues to incorporate new and emerging paradigms in all aspects of teaching and education while maintaining rigorous standards in traditional approaches to engineered solutions of environmental problems. Graduates of the program possess technical expertise required to maintain a healthy balance between societal welfare, economic growth and the environment surrounding us.

The **Program Educational Objectives** of our Environmental Engineering Bachelor of Science program are to prepare environmental engineering graduates to:

1. Develop careers in environmental engineering and other professionally related fields.
2. Seek additional professional training and personal development.
3. Apply their skills to develop innovative solutions and technologies.
4. Pursue professional licensure and/or certification.
5. Advance to become members of professional societies and future leaders in their profession.

To achieve the program education objectives, the environmental engineering program has adopted the following seven ABET student outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

EDUCATIONAL AND CAREER OPPORTUNITIES

In each curriculum, emphasis is placed on the development of a solid knowledge of civil or environmental engineering fundamentals. Both undergraduate programs include a strong base of mathematics, including calculus, probability and statistics, and the physical sciences, followed by a course in planning and engineering economics. A broad range of required and elective courses in engineering science, analysis and design in the areas listed above meet each set of program objectives. Elective courses in the programs extend across a wide array of areas including structural engineering, geotechnical engineering, water resources engineering, environmental engineering, transportation engineering, construction management, and project management. Additional elective courses in the environmental engineering program are available from chemical engineering, chemistry, biology, and earth and environmental science. Five-year programs are available for students interested in a second bachelor's degree in a major in the College of Arts and Sciences (see listings under Arts-Engineering (p. 403); Civil Engineering and Earth and Environmental Sciences (p. 432)) and the Bachelor's to Master's Accelerated Program is available for eligible students interested in continuing for a master's degree at Lehigh (see listing under the P.C. Rossin College of Engineering and Applied Science (https://catalog.lehigh.edu/coursesprogramsandcurricula/engineeringandappliedscience/)).

The civil and environmental engineering programs prepare individuals for entry into the engineering profession or for entry into high-quality programs of graduate study. With proper selection of electives, students may also prepare for entrance into schools of law or medicine, or into master's-level programs in engineering management or business administration.

For additional useful information visit our departmental website https://engineering.lehigh.edu/cee (https://engineering.lehigh.edu/cee/).

- Civil Engineering (p. 422)
- Environmental Engineering (p. 423)
- Technical Minor in Environmental Engineering (p. 423)

B.S. IN CIVIL ENGINEERING

Required Courses

A total of 130 credit hours are required for graduation with the degree of Bachelor of Science in Civil Engineering.

Recommended Sequence of Courses

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible.

First Year

First Semester	Credits	Second Semester	Credits
ENGR 005	2	CHM 030	4
MATH 021	4	ECO 001	4
PHY 011	4	ENGR 010	2
PHY 012	1	MATH 022	4
WRT 001	3	WRT 002	3
	14		**17**

Second Year

First Semester	Credits	Second Semester	Credits
CEE 003	3	CEE 059	3
CEE 010 or 195	3	CEE 117	2
CEE 011	1	CEE 170	4
CEE 012	2	MATH 205	3
MATH 023	4	PHY 021	4
HSS Humanities/Social Sciences Elective	3	PHY 022	1
	16		**17**

Third Year

First Semester	Credits	Second Semester	Credits
CEE 122	3	CEE 123	3
CEE 142	3	CEE 202	3
CEE 159	4	CEE 222	3
BSE Basic Science Elective[1]	3	CEE 242	3
HSS Humanities/Social Sciences Elective	4	CEE 262 or 264	3
		AE CEE Approved Elective[2]	3
	17		**18**

Fourth Year

First Semester	Credits	Second Semester	Credits
CEE 203	2	CEE 290	3
AE CEE Approved Electives[2]	8	AE CEE Approved Electives[2]	6
HSS Humanities/Social Sciences Elective	3	HSS Humanities/Social Science Elective	3
FE Free Elective	3	FE Free Elective	3
	16		**15**

Total Credits: 130

[1]

Basic Science Elective; list of approved courses is available from CEE department.

[2]

Seventeen CEE elective credits approved by the CEE department; list available from department.

The selection of elective courses is to be in consultation with student's academic adviser in the Department of Civil and Environmental Engineering.

B.S. IN ENVIRONMENTAL ENGINEERING

Required Courses

A total of 131 credit hours are required for graduation with the degree Bachelor of Science in Environmental Engineering.

Recommended Sequence of Courses

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible. Three of these HSS credits must be an approved course that meets the Environmental Studies Requirement.

First Year

First Semester	Credits	Second Semester	Credits
ENGR 005	2	ENGR 010	2
CHM 030	4	MATH 022	4
MATH 021	4	PHY 011	4
WRT 001	3	PHY 012	1
FE Free Elective	3	WRT 002	3
	16		**14**

Second Year

First Semester	Credits	Second Semester	Credits
CEE 003, MECH 002, or MECH 003	3	CEE 170	4
CEE 012	2	CEE 272	2
ECO 001	4	CHM 031	4
EES 022	1	MATH 205	3
MATH 023	4	PHY 021	4
ESR Earth Science Requirement[3]	3	PHY 022	1
	17		**18**

Third Year

First Semester	Credits	Second Semester	Credits
CEE 122	3	CEE 202	3
CEE 142	3	CEE 222	3
CEE 375	3	CEE 274	3
CHE 031	3	CEE 275	2
CHM 110	3	EBR Environmental Biology Requirement[4]	3
CHM 111	1	HSS Humanities/Social Sciences Elective[1]	4
	16		**18**

Fourth Year

First Semester	Credits	Second Semester	Credits
CEE 203	2	CEE 377	3
CEE 378	3	AE Approved Electives[2]	6
AE Approved Elective[2]	6	HSS Humanities/Social Science Elective[1]	6
HSS Humanities/Social Sciences Elective[1]	3		
FE Free Elective	3		
	17		**15**

Total Credits: 131

[1]

HSS Advanced requirement is 13 credits, three credits of which must be an approved course that meets the Environmental Studies Requirement; the list of approved courses is available from CEE department.

[2]

Twelve approved elective credits to satisfy proficiency in four focus areas of water supply and resources, environmental chemistry, waste management, and biological processes. Approved list of courses available from CEE department.

[3]

Earth Science Requirement, list of approved courses is available from CEE department.

[4]

Environmental Biology Requirement, list of approved courses is available from CEE department.

The selection of elective courses is to be in consultation with student's academic adviser in the Department of Civil and Environmental Engineering.

TECHNICAL MINOR IN ENVIRONMENTAL ENGINEERING

A technical minor in Environmental Engineering is available for students outside the department. At least two of the courses must be from the CEE department.

CHM 031	Chemical Equilibria in Aqueous Systems (Prerequisite)	4
Select three of the following required courses:		9-10
CEE 170	Introduction to Environmental Engineering	
CEE 274	Environmental Water Chemistry	
CEE/CHE 373	Fundamentals of Air Pollution	
CEE/CHE 375	Environmental Engineering Processes	
Select one additional course from the required list or from the following:		3
CEE 222	Water Resources Engineering	
CEE/EES 323	Environmental Groundwater Hydrology	
CEE/EES 327	Surface Water Quality Modeling	
CEE 345	Geo-Environmental Engineering	
CEE 370	Environmental Separation and Control	
CEE 371	Reaction Kinetics in Environmental Engineering	
Other courses may be selected with the minor adviser's approval.		

GRADUATE PROGRAMS

The Department of Civil and Environmental Engineering (CEE) has graduate degree programs leading to Master's and Ph.D. degrees in: Civil Engineering, Structural Engineering, and Environmental Engineering.

The department offers advanced work in the specialty areas of **structural engineering**, **geotechnical engineering**, **water resources engineering**, and **environmental engineering.** Degrees offered are:

M.Eng., M.S., Ph.D. in Structural Engineering

M.Eng., M.S., Ph.D. in Civil Engineering

M.Eng., M.S., Ph.D. in Environmental Engineering

The programs educate students through coursework and independent study and research. Our programs are designed to provide students

with the knowledge and analytical problem-solving capabilities needed to lead and innovate within multi-disciplinary teams in technologically-complex environments.

Graduate studies in the department of civil and environmental engineering enable the student to build upon the broad background of undergraduate education in preparation for professional practice at an advanced level, for research and development, or for teaching.

A graduate program leading to the M.S. normally is concentrated in one, or possibly two, of the technical specialty areas, and consists of a number of courses designed to fulfill the individual student's program objectives. Each candidate for the M.S. is required to submit a thesis representing three to six credit hours (CEE 491), or alternatively, a report based on a research course of at least three credits (CEE 429, CEE 439, CEE 449, CEE 479 or CEE 481). The balance of the program will consist of courses in the specialty area(s).

A graduate program leading to the M.Eng. degree stresses engineering applications and design. The department offers two different M.Eng. degrees. The M.Eng. in Structural Engineering focuses specifically on structural engineering. Candidates for the M.Eng. in Structural Engineering degree complete a group design project and an individual project as part of a 3-course design project sequence (CEE 416, CEE 417, CEE 418). The M.Eng. degrees in Civil Engineering and Environmental Engineering allow students to select courses across the various specialty areas of civil and environmental engineering. Candidates for the M.Eng. degrees in Civil Engineering and Environmental Engineering have the option to complete an individual engineering project or a research report, representing 3 to 6 credits (CEE 480), or may take 30 course credits with no project or report.

The doctoral program, which leads to the Ph.D., normally includes courses in the major field, courses in minor fields, and a dissertation presenting results of original research. Holders of master's degrees planning to become candidates for the Ph.D. take a qualifying examination. After qualification, the candidate, the candidate's departmental Ph.D. committee, and the department chair formulate the program of work.

The departmental laboratories are located in the Fritz Engineering Laboratory and in the STEPS Building. The laboratories offer outstanding facilities for research and instruction in structural engineering, geotechnical engineering, water resources engineering, and environmental engineering. In particular, the structural testing equipment includes dynamic testing machines, a five-million-pound universal hydraulic testing machine, and other state-of-the-art facilities. Included in the latter are the facilities of the Center for Advanced Technology for Large Structural Systems (ATLSS center) located on the Mountaintop campus. These include the largest 3-dimensional test bed in the U.S.A. and specialized earthquake testing facilities of the NSF George E. Brown, Jr. Network Earthquake Engineering Simulation (NEES). The water resources facilities include a wave tank, several flumes, a 10-cfs recirculating flow system, and two multipurpose tanks for model studies. The geotechnical facilities include state-of-the-art, fully automated triaxial compression and permeability machines for multiple simultaneous tests. The environmental facilities include state-of-the-art laboratories and analytical instrumentation for analysis of chemical, physical and microbiological systems.

In addition to departmental courses, a number of courses offered by the departments of mechanical engineering and mechanics, chemistry, chemical engineering, materials science and engineering, earth and environmental sciences, and biology may also be considered a part of the major field in civil and environmental engineering. A number of research and teaching assistantships are available to provide financial support to students of outstanding promise. The research or teaching activities required of holders of assistantships provides a valuable educational experience that supplements the formal course offerings. A very limited number of scholarships and fellowships are available to provide financial support for full-time study.

Courses

CEE 003 Engineering Statics 3 Credits
Force and moment vectors, resultants. Principles of statics and free-body diagrams. Applications to simple trusses, frames, and machines. Distributed loads. Internal forces in beams. Properties of areas, second moments. Laws of friction. is intended as a prerequisite for CEE 059.
Prerequisites: PHY 011 and (MATH 022 or MATH 096)
Can be taken Concurrently: MATH 022, MATH 096

CEE 010 (ARCH 010) Engineering/Architectural Graphics and Design 0,3 Credits
Graphical communication of civil engineering and architectural projects using manual techniques and commercial state-of-the-art computer software. Topics include visualization and sketching; orthographic, isometric and other drawings; points, lines and planes in descriptive geometry; site design; overview of geographical information systems and 3-D applications. Teamwork on design projects with oral and graphical presentations. Open to a limited number of architecture, design arts or other students with project roles consistent with students' background. Not available to students who have taken ME 010.
Attribute/Distribution: AL

CEE 011 Surveying 0,1 Credits
Theory and practice of basic engineering surveying measurements and analysis. Topics to include field note taking, datums and measurement precision, equipment and techniques for measuring distance, elevation and angles, electronic distance measurement, topographic surveys, GPS and hydrographic surveys. Hands on experience with the use of survey levels, transits/theodolites and a total station will be provided.

CEE 012 Engineering Probability and Statistics 2 Credits
Basic engineering statistics with a civil & environmental engineering focus. Topics to include: random variables and histograms; central tendency, dispersion and skew; probability density functions and cumulative distribution functions, basic probability concepts and selected probability models, return period analysis, linear regression and least squares, correlation analysis, propagation of errors.
Prerequisites: MATH 021

CEE 059 Strength of Materials 3 Credits
Analysis of stress and strain; Hooke's law; effect of axial load, bending moment, transverse shear, and torsion in beams of generic cross section; composite beams; inelastic bending; eccentric axial loading; shear center; Euler's instability; Mohr's circle for stress; stress combination; failure criteria.
Prerequisites: CEE 003 and MATH 023
Can be taken Concurrently: MATH 023

CEE 102 (CGH 102) Community Health and Engineering 3 Credits
This course is an introduction to public health engineering. Students will learn to define hazards and risks to community health such as air pollution; water, sanitation, and hygiene; food; and settlement/safety. The focus of the course will be on understanding engineering controls to reduce risk and improve communicable and non-communicable disease outcomes. This course includes elements of waterborne disease control, hazardous materials management, occupational health and safety, and environmental interventions.

CEE 104 Readings in Civil Engineering 1-4 Credits
Study of selected technical papers, with abstracts and reports. Consent of the department chair required.

CEE 117 Numerical Methods in Civil Engineering 2 Credits
Techniques for computer solution of linear and non-linear simultaneous equations; eigenvalue analysis; finite differences; numerical integration; numerical solutions to ordinary differential equations. Case studies in the various branches of civil engineering.
Prerequisites: MATH 205
Can be taken Concurrently: MATH 205

CEE 122 Fluid Mechanics 0,3 Credits
Fluid properties and statics; concepts and basic equations for fluid dynamics. Forces caused by flowing fluids and energy required to transport fluids. Dynamics similitude and modeling of fluid flows. Includes laboratory experiments to demonstrate basic concepts.
Prerequisites: MECH 002 or MECH 003 or CEE 003

CEE 123 Civil Engineering Materials 0,3 Credits
Properties of commonly used civil engineering materials including aggregate, Portland cement concrete, asphalt, concrete, wood, metals, and polymer based synthetics. Standard test methods. Includes laboratory work and reporting of results.
Prerequisites: CEE 059 or MECH 012

CEE 142 Soil Mechanics 0,3 Credits
Physical properties of soils; mineralogy, composition and fabric. Phase and weight-volume relationships, consistency, gradation and classification of soils. Fluid flow through porous media. Stress-strain behavior; stresses within a soil mass, deformation behavior, measurement of stress-strain properties, shear strength of soil. Volume change in soils; compressibility, pore water pressure, consolidation and settlement. Laboratory experiments to measure physical and mechanical properties of soils.
Prerequisites: MECH 002 or MECH 003 or CEE 003

CEE 159 Structural Analysis I 0,4 Credits
Elastic analysis of statically determinate beams, frames, and trusses; deflections by the methods of virtual work and moment area; influence lines for determinate structures; modeling for structural analysis; flexibility, stiffness, and approximate methods of analysis of indeterminate structures.
Prerequisites: CEE 059

CEE 170 Introduction to Environmental Engineering 0,4 Credits
Characterization and evaluation of natural water resources. Principles of basic water chemistry. Water and wastewater treatment processes. Sludge treatment, air pollution and multi-media transport. Pollutants mass balance and oxygen transfer. Field trips to water and wastewater process facilities. Laboratory experiments on water and wastewater characterization.
Prerequisites: CHM 030

CEE 171 (CHE 171, EMC 171) Fundamentals of Environmental Technology 4 Credits
Introduction to water and air quality, water, air and soil pollution. Chemistry of common pollutants. Technologies for water purification, wastewater treatment, solid hazardous waste management, environmental remediation, and air quality control. Global changes, energy and environment. Constraints of environmental protection on technology development and applications. Constraints of economic development on environmental quality. Environmental life cycle analysis and environmental policy. Not available to students in RCEAS.

CEE 202 CEE Planning and Engineering Economics 3 Credits
The planning and management of civil engineering projects. Modeling and optimization methods, project management techniques. Financial decision-making among alternatives. Present value and discounted cash flow analysis; incremental analysis and rate-of-return criteria.

CEE 203 Professional Development 2 Credits
Elements of professionalism; professional ethics; engineering registration; continuing education; responsibilities of an engineer in industry, government, private practice; role of professional and technical societies.

CEE 205 Design Problems 1-3 Credits
Supervised individual design problems, with report. Consent of the department chair required.
Repeat Status: Course may be repeated.

CEE 207 Transportation Engineering 3 Credits
Principles of the design of transportation facilities with emphasis on highways and airports in the areas of geometric, drainage, and pavement design. Design problems.
Prerequisites: CEE 011

CEE 211 Research Problems 1-3 Credits
Supervised individual research problems, with report. Consent of the department chair required.
Repeat Status: Course may be repeated.

CEE 222 Water Resources Engineering 0,3 Credits
Pipe and pump hydraulics, surface and ground water hydrology, and open channel hydraulics. Laboratory experiments in applied hydraulics.
Prerequisites: CEE 122 or ME 231

CEE 242 Geotechnical Engineering 3 Credits
The principles related to analysis and evaluation of earthen infrastructure. Site characterization and in-situ testing of soils. Advanced stress-strain behavior, failure theories and stress path application. Stability of earthen structures; slopes, dams and levees. Stability of retaining structures; lateral earth pressures. Introduction to shallow foundations; bearing capacity and settlement.
Prerequisites: CEE 142

CEE 258 Structural Laboratory 3 Credits
Experimental study of behavior of members and structures. Planning, executing, and reporting experimental studies. Introduction to instrumentation and data acquisition. Nondestructive testing of civil engineering structures. Steel, rein-forced concrete, and other materials.
Prerequisites: CEE 262 and CEE 264

CEE 262 Fundamentals of Structural Steel Design 3 Credits
Introduction to steel structures. Behavior, strength and design of structural members, including members subjected to axial tension, axial compression, flexure and combined compression and flexure. Basic methods of joining members to form a structural system. Use of design specifications.
Prerequisites: CEE 159

CEE 264 Fundamentals of Structural Concrete Design 3 Credits
Analysis, design, and detailing of reinforced concrete members and simple systems for strength and serviceability requirements, including beams, columns, and slabs. Introduction to prestressed concrete.
Prerequisites: CEE 159

CEE 266 Construction Management 3 Credits
An overview of management and construction techniques used in engineering ventures and projects. Scheduling, estimation, construction methods, financial controls, contracts, labor relations and organizational forms. Case studies and lecturers from industry.
Prerequisites: CEE 202

CEE 272 Environmental Risk Assessment 2 Credits
Effects of chemical releases on human health; ecological risks. Application of risk assessment methodology, including hazard identification, exposure assessment, toxicity assessment, and risk characterization. Accounting for uncertainty in data during risk management, risk reduction and implementation of regulations and environmental policy.

CEE 274 Environmental Water Chemistry 3 Credits
Chemical principles and applications of those principles to the analysis and understanding of aqueous environmental chemistry in natural waters and wastewaters. The chemistry of ionic equilibria, redox reactions, precipitation/dissolution, acid-base concepts, buffer capacity, complexation, hydrolysis and biological reactions.
Prerequisites: CHM 031 or CEE 170

CEE 275 Environmental, Geotechnics and Hydraulics Laboratory 0,2 Credits
Applying fundamentals of soil properties, hydraulics and environmental science through appropriate laboratory experiments for solution of environmental engineering problems. Experiments will include solute transport in surface and subsurface medium; characterization of soils, sludges and water; treatment of water and wastewater including biological processes. Illustration of techniques to generate design parameters for scale-up.
Prerequisites: CEE 170 and CEE 274
Can be taken Concurrently: CEE 274

CEE 279 Microbial Ecology 4 Credits
The role of microorganisms in the environment. Topics include: Survey of microbial classification, structure, and metabolism; study of microbes at population, community, and ecosystem levels of organization; the role of microbes in biogeochemical cycles; application of microbes to bioremediation and resource recovery problems.
Prerequisites: EES 152

CEE 281 Special Topics 1-3 Credits
A study of selected topics in civil and environmental engineering not included in other formal courses. A design project or an interdisciplinary study of a problem related to civil or environmental engineering may be included. Civil and environmental engineering students working on design projects involving students from other departments or colleges working in cross-disciplinary teams may be included. A report is required. Consent of the department chair required.
Repeat Status: Course may be repeated.

CEE 290 CEE Design Project 3 Credits
Supervised design projects. Multidisciplinary teams applying the fundamentals of engineering science and the concepts of planning and systems analysis in the design of practical engineering works. The scope includes needs analysis, formulation of the design problem statement and evaluative criteria; analysis of alternative solutions and the generation of specifications. Includes most of the following considerations: economic, sustainability, manufacturability, ethical, social, environmental, aesthetic, political, health and safety. Practicing professional engineers are invited to serve as consultants. Written and oral reports are required. Must have senior standing in CEE department.

CEE 301 Modeling Environmental Systems 3 Credits
Apply flow and contaminant transport models to engineered environments and surface and subsurface natural environments. Formulation of problem statements in terms of ordinary and partial differential equations, boundary conditions, and parameters. Apply finite difference techniques using contemporary software. Solution of systems of linear and nonlinear equations. Introduction to finite elements.
Prerequisites: CEE 121 or MATH 205

CEE 316 (EES 316) Hydrogeology 0-4 Credits
Water plays a critical role in the physical, chemical, and biological processes that occur at the Earth's surface. This course is an introduction to surface and groundwater hydrology in natural systems, providing fundamental concepts and a process-level understanding using the hydrologic cycle as a framework. Geochemistry will be integrated to address natural variations and the human impact on the environment. Topics covered include: watershed hydrology, regional and local groundwater flow, water chemistry, and management of water resources. Lectures and laboratory.
Prerequisites: (EES 080 and EES 115 or EES 131 or EES 152) or (CEE 170)
Can be taken Concurrently: EES 115, EES 131, EES 152
Attribute/Distribution: NS, Q, W

CEE 320 (EES 320) Engineering Hydrology 3 Credits
Rainfall-runoff analysis, overland flow, hydrograph theories, modeling. Frequency analysis of extreme events. Flood routing. Design storms. Floodplain hydraulics, floodplain delineation.
Prerequisites: (CEE 222)
Attribute/Distribution: NS

CEE 322 Water Resources Engineering II 3 Credits
Advanced topics in fluid mechanics, free surface flows, hydraulic structures, and in pipe hydraulics including pipe network systems.
Prerequisites: CEE 222

CEE 323 (EES 323) Environmental Groundwater Hydrology 3 Credits
The study of subsurface water, its environment, distribution, and movement. Included are flow patterns, well hydraulics, and an introduction to the movement of contaminants. Design problems are included to simulate flow with analytical and numerical models, and contaminant migration using analytical models.
Prerequisites: CEE 122 or CEE 316 or EES 316 or ME 231 or CHE 044

CEE 325 Hydraulics of Sediment Transport 3 Credits
Hydrodynamic forces on particles, settling velocity. Sediment transport in open channel: tractive force theory, bed load and suspension theory, total load and wash load. Bedform mechanics, cohesive channel hydraulics. Sediment transport in closed conduits. Shore processes and coastline hydraulics. Students cannot receive credit for both CEE 325 and 425.
Prerequisites: CEE 222

CEE 326 GIS for Civil and Environmental Engineering 3 Credits
Introduction to theory, concepts and techniques related to the creation, manipulation, processing, and basic analysis of spatial data using geographical information systems (GIS) for real world engineering problems. Topics include: basic GIS concept, map projection and coordinate system, spatial data format and editing, spatial analysis, network analysis and developing simple GIS models. Multiple GIS tools are introduced. Lecture and laboratory.

CEE 327 (EES 327) Surface Water Quality Modeling 3 Credits
Fundamentals of modeling water quality parameters in receiving water bodies, including rivers, lakes, and estuaries. Modeling of dissolved oxygen, nutrients, temperature, and toxic substances. Emphasis on water quality control decisions as well as mechanics and model building.
Prerequisites: (CEE 122 or ME 231 or CHE 044) and CEE 222

CEE 331 Catastrophe Modeling and Resilience 3 Credits
Introduction to catastrophe modeling and resilience terminology, methods, and tools. General framework of catastrophe modeling and resilience assessment, with simple applications to various fields. Description of hazard, fragility, vulnerability and portfolio analysis. Effect of climate change. Research methods, scientific communication. Use of catastrophe risk and resilience modeling software and databases. Societal impact and ethical concerns raised by catastrophe insurance and resilience enhancement. Guest lectures from experts and term project. This undergraduate version of CAT 401 has simplified assignments.

CEE 332 Applications of Catastrophe Modeling and Resilience 3 Credits
Advanced analyses of various applications of catastrophe models, such as natural disasters or health-related threats to inform management and policies. Course activities include 1) reading recent publications on catastrophe model development, application and limitations, 2) practical exercises, in-class and as homework, about deterministic and stochastic model construction, and 3) result visualization of disaster impacts via geographic information systems. Theory and context-dependent practical problems on catastrophe model parameterization are covered. This undergraduate version of CAT 402 has simplified assignments.
Prerequisites: CEE 331 or CAT 401
Can be taken Concurrently: CEE 331, CAT 401

CEE 337 Interdependent Sustainable Urban Systems 3 Credits
Multidisciplinary application of modelling, optimization and control principles to interactive cyber-physical systems (CPSs) such as water, energy, transportation, and buildings. Analysis of complex urban systems, which are large-scale nonlinear civil systems composed of interconnected or interwoven parts. Topics include differential equation-based models of civil infrastructure systems; time and frequency domain representations; linear and non-linear model predictive control methods; dynamical behavior of the system; model analysis; and controllability. Students cannot receive credit for both CEE 337 and CEE 437.
Prerequisites: MATH 205

CEE 340 Advanced Foundation Engineering 3 Credits
Current theory and practice relating to the design of deep foundations supporting buildings and other structures. Construction practices; analysis and design (bearing capacity, settlement, dynamic effects); site investigations; load-resistance-factor design (LRFD) criteria for foundations.
Prerequisites: CEE 242

CEE 341 Ground Improvement and Site Development 3 Credits
Soil stabilization; grouting and injection methods; preloading and dynamic consolidation; deep compaction; drainage and dewatering; application of geotextiles and geomembranes; soil nailing and reinforcement methods. Use of in-situ test for soil properties and site characterization; procedures and calibration methods for the basic in-situ tests - SPT, CPT, CPTU, DMT; theoretical, experimental and empirical interpretive methods for in-situ test results.
Prerequisites: CEE 142

CEE 342 Experimental Geotechnical Engineering 3 Credits
Experimental studies dealing with the measurement of soil and other particulate materials properties, and behavior in the laboratory. Test procedures, calibration, data acquisition, interpretation of apparatus limitations and potential error sources, specimen preparation, data analysis and interpretation; designing experiments. Senior standing required.
Prerequisites: CEE 242

CEE 344 Behavior of Soils as Engineering Materials 3 Credits
Soil mineralogy, bondage, crystal structure and surface characteristics; clay-water electrolyte system; soil fabric and its measurement; soil structure and physical property relationships; soil depositional and compositional characteristics; engineering properties of soils as they relate to soil mineralogy, fabric and composition: volume change behavior, intergranular stresses, shear strength and deformation behavior, conduction behavior, coupled and direct flow phenomena.
Prerequisites: CEE 142

CEE 345 Geo-Environmental Engineering 3 Credits
Principles of interaction of soil and rock with various environmental cycles. Physical and chemical properties of soil. Soil fabric and its measurement, clay-water electrolyte system, electrical double layer; contaminated site characterization, groundwater flow and contaminant transport; detection and quantification technologies; waste containment systems, landfills, liner systems, leachate collection; soil and groundwater cleanup technologies.
Prerequisites: CEE 142

CEE 346 Geotechnical and Environmental Applications of Geosynthetics 3 Credits
Fundamental and current theories of designing soil structures with geosynthetics. Waste containment systems; landfills, vertical barriers and slurry walls; erosion control; filtration and drainage systems; reinforced embankments and stabilized slopes.
Prerequisites: CEE 142

CEE 347 Foundation Engineering 3 Credits
Application of theories and principles of soil mechanics to geotechnical and structural foundation design. In-situ soil testing, subsurface exploration and soil sampling. Bearing capacity, settlement, lateral earth pressure principles. Design of shallow foundations: spread footings, beams on elastic foundations, mat foundations. Introduction to retaining walls: mechanically stabilized earth, concrete and sheet pile walls, walls for excavations. Design of deep foundations: single piles, pile foundations, drilled piers and caissons.
Prerequisites: CEE 242

CEE 351 Advanced Structural Concrete Design 3 Credits
Advanced analysis, design and detailing of reinforced concrete members and systems. Topics include two-way slab systems, biaxial bending of beam-columns, slender columns, torsion, yield line analysis, strut-and-tie models.
Prerequisites: CEE 264

CEE 352 Structural Dynamics 3 Credits
Analysis of linear structural systems to time-dependent loads. Free and forced vibration. Classical and numerical methods of solution. Lumped-mass techniques, energy methods, and introduction to matrix formulation of dynamic problems. Application to design.
Prerequisites: MATH 205 and CEE 159 and MECH 102

CEE 354 Sensors, Signals, and Systems 3 Credits
Characterization of sensing systems and analysis and processing of sensor data. Topics include formulation of signals in time and frequency domains: sampling, Nyquist theorem, interpolation, band-limited signals. Analysis of systems: LTI systems, convolution, Eigenfunctions, poles and zeros. Design and analysis of digital filters: ideal filters, FIR filters, filter behavior. Spectral analysis and system identification: stationary processes, power spectral density, frequency leakage. Fundamentals of sensing systems: piezoelectricity, actuation, measurement parameters.

CEE 358 Random Vibrations 3 Credits
Review of probability theory. General characterization and models of random functions for engineering applications (seismic ground motion, wind velocity, ocean waves, mechanical vibrations). Vibration of deterministic systems under random dynamic loads; applications to wind and seismic engineering. Uncertain systems under random perturbations, simulation of random functions for numerical solutions (non-stationary, non-Gaussian, multi-variate processes, multi-dimensional fields).
Prerequisites: CEE 352
Can be taken Concurrently: CEE 352

CEE 359 3 Credits
Concepts of virtual work and applications to determination of equilibrium and deflections of structures. Analysis of statically indeterminate structures, methods of consistent deformations, slope deflection and moment distribution; consideration of side-sway and non-prismatic members. Flexibility and stiffness matrix methods for computerized analysis. Application of computer analysis software for advanced structural analysis. Graduate students who have not taken CEE 159 should contact instructor to inquire about a prerequisite waiver.
Prerequisites: CEE 159

CEE 361 Bridge Systems Design 3 Credits
Introduction to bridge structural systems in steel and concrete. Loads and specifications. Design and analysis of bridge structural components.
Prerequisites: CEE 359 and CEE 262 and CEE 264

CEE 363 Building Systems Design 3 Credits
Building structural systems in steel, reinforced concrete and composite steel and concrete. Design loads (dead, live and environmental) and methodologies. Structural systems behavior and design. Design of floor systems, beam-columns, connections, walls, and overall frames. Final design.
Prerequisites: CEE 359 and CEE 262 and CEE 264

CEE 364 Advanced Project Management 3 Credits
Interrelations of planning, design, construction, operation and maintenance, and decommissioning. Project life cycle cost analysis. Cost estimating and financial management principles. Economic feasibility studies. Advanced construction methods and construction contracting.
Prerequisites: (CEE 266)

CEE 365 Prestressed Concrete 3 Credits
Principles of prestressing. Analysis and design of basic flexural members. Instantaneous and time-dependent properties of materials. Prestress losses. Additional topics may include continuity, partial prestressing, compression members, circular prestressing, etc.
Prerequisites: CEE 264

CEE 366 Finite Element Method in Structural Engineering 3 Credits
The finite element method: fundamental concepts, theory, modeling, and computation for the analysis of structures. One, two, and three-dimensional finite elements. Isoparametric formulation and implementation for various kinds of elements. Applications to problems in the behavior of structural elements and systems including analysis of trusses, beams, plates, and frames and bridge systems. Extensions to nonlinear analysis and advanced topics. Use of contemporary commercial software.
Prerequisites: CEE 359

CEE 370 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes.
Prerequisites: CEE 371

CEE 371 Reaction Kinetics in Environmental Engineering 3 Credits
Theory of reaction kinetics and its application to the design and operation of chemical, physico-chemical and biological reactions in water, wastewater, and hazardous waste treatment. Basic design equations for various types of reactors and migration of pollutants in the environment.
Prerequisites: CEE 375 or CHE 375

CEE 373 (CHE 373) Fundamentals of Air Pollution 3 Credits
Introduction to the problems of air pollution including such topics as: sources and dispersion of pollutants, sampling and analysis; technology of economics and control processes; legislation and standards. Must have senior standing in the College of Engineering and Applied Science.

CEE 375 (CHE 375) Environmental Engineering Processes 3 Credits
Fundamental physical, chemical and microbiological processes applied in environmental engineering for air pollution control, treatment of drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Kinetics, reactor theory, mass balances, application of fundamental physical, chemical and microbiological principles to analysis and design.
Prerequisites: CEE 170 and CHM 031

CEE 376 Environmental Biotechnology 3 Credits
Fundamentals of microbiology and biochemistry applied to natural and engineered environmental systems. Systems ecology, energetics and kinetics of microbial growth, nutrition and toxicology, use of microorganisms for pollution monitoring and control. Pathogenicity and disease transmission, water quality using biological indices.
Prerequisites: CEE 375 or CHE 375

CEE 377 Environmental Engineering Design 3 Credits
Team-oriented course to develop design skills in the area of environmental engineering. Project components typically include: air pollution, drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Project work typically includes: a background report, a design report, and an oral presentation. Tools used in the design process may include simulation models. Must have senior standing in CEE department.
Prerequisites: CEE 375

CEE 378 Hazardous Waste Treatment and Management 3 Credits
Regulations for collection, transportation, disposal and storage of hazardous wastes. Containment systems, monitoring, new and available technologies to minimize, transform, destroy, detoxify and eliminate the hazardous components of the wastes. Environmentally benign processes and life cycle analysis.
Prerequisites: CEE 375 or CHE 375

CEE 379 (EES 379) Environmental Case Studies 3 Credits
Case studies will be used to explore the impact of politics, economics, society, technology, and ethics on environmental projects and preferences. Environmental issues in both affluent and developing countries will be analyzed. Multidisciplinary student teams will investigate site characterization; environmental remediation design; environmental policy; and political, financial, social, and ethical implications of environmental projects.
Prerequisites: (EES 022 or CEE 375 or CHE 375)

CEE 381 Special Topics 1-3 Credits
A study of selected topics in civil and environmental engineering, not included in other formal courses. A report is required. Consent of the department chair required.

CEE 384 Advanced Environmental Chemistry 3 Credits
Environmental organic chemical classifications, chemical partitioning between phases (air-water, air-organic, and multi-phase partitioning), Linear Free Energy Relationships (LFER), sorption isotherms, organic chemical partitioning in living media, transformation reactions, and modeling of organic chemical transport with reactions.
Prerequisites: CEE 274 and CEE 375

CEE 385 Research Procedures Seminar 1 Credit
Planning and execution of research projects, survey of current research, elements of proposals and budgets. Literature search procedures. Presentation of data, and of written and oral reports. Guidelines for visual aids.

CEE 401 Modeling Environmental Systems 1-3 Credits
Apply flow and contaminant transport models to engineered environments and surface and subsurface natural environments. Formulation of problem statements in terms of ordinary and partial differential equations, boundary conditions, and parameters. Apply finite difference techniques using contemporary software. Solution of systems of linear and nonlinear equations. Introduction to finite elements. Students cannot receive credit for both CEE 401 and CEE 301.
Prerequisites: CEE 122 or MATH 205

CEE 404 Mechanics and Behavior of Structural Members 3 Credits
Behavior of structural members, under a variety of loading conditions in the elastic and inelastic range. Introduction to the theory of elasticity and plasticity. Basics of linear elastic fracture mechanics and fatigue. Analysis of structural member behavior in axial, bending, shear, and torsion. Stability analysis of beam-columns. Energy concepts and their use in structural analysis.

CEE 405 Analytical and Numerical Methods I 3 Credits
Analytical and numerical methods used in Civil Engineering, with emphasis on ordinary and partial differential equations. Analytical and numerical solutions of ordinary and partial differential equations. Initial and boundary value problems. Numerical integration, numerical error, and approximations of functions and data points. Finite differences, solution of systems of linear equations, eigenvalue problems, and solution of nonlinear equations.
Prerequisites: MATH 205

CEE 406 Structural Reliability of Components and Systems 3 Credits
Probabilistic time –invariant failure analysis of structural components and systems. Statistics and probability; component time-invariant reliability analysis; system time-invariant reliability analysis; reliability-based structural design; and reliability of structural systems using Monte-Carlo simulation. Solutions suitable for practical computer implementation.

CEE 409 Finite Element Method in Structural Mechanics 3 Credits
Basic principles and equations governing the finite element method. Analysis of planar, axisymmetric, plate and articulated structures, with emphasis on analytical modeling. Accuracy and convergence studies, utilizing different discretizations and various types of elements. Case studies include application and extension to material nonlinearities, bridges, containment vessels, and soil-structure interaction.
Prerequisites: CEE 405

CEE 412 Methodologies of Structural Design 2 Credits
Probabilistic analysis of uncertainties associated with structural design. Characterization of loads including dead and live loads, wind, earthquake, and vehicular loads. Variability of structural resistance based on strength limit states as well as serviceability. Assessment of safety and reliability. Deterministic and probabilistic methodologies of design.

CEE 414 Analysis and Design of Steel and Composite Structural Members 3 Credits
Fundamentals of limit state design. Ultimate strength analysis of steel and steel-and-concrete composite columns, beams, beam-columns, and members subjected to torsion and combined torsion and bending. Flexural and torsional instability. Background and requirements of current design codes.

CEE 415 Analysis and Design of Ductile Steel Structural Systems 3 Credits
Inelastic behavior of steel and steel structural members. Plastic limit strength analysis of continuous beams and frames. Effect of variable repeated loading. Methodology and code requirements for design based on plastic strength. Applications to seismic-resistant building structures. Current research.
Prerequisites: CEE 262

CEE 416 Design Project I 3 Credits
Introduction to the overall M.Eng. design project for a civil infrastructure facility. Design decision making and communication processes. Roles of various players in the execution of the project (e.g. owner, architect, engineer, fabricator, construction manager, contractor), and the mechanisms of communication of information in the design process (e.g. design drawings, shop drawings, erection drawings, as-built drawings). Roles of codes and standards. Enrollment limited to students in M.Eng. program.

CEE 417 Design Project II 0,3 Credits
Task-specific teams will be organized to perform preliminary designs of different design options for the ocerall design project. Determination of project goals, performance requirements, and functional specifications. Winnowing and selection of alternatives for final design. Professor of practice and external specialists will guide examination and evaluation of design options based on cost and performance criteria.
Prerequisites: CEE 416

CEE 418 Design Project III 0,3 Credits
Comprehensive, completed design of the civil infrastructure facility. Design project teams will address life cycle issues and integrated, multidisciplinary aspects of architecture, systems design, construction and management. Critical design reviews will be performed by teams of external specialists and members of the industrial advisory board.
Prerequisites: CEE 417

CEE 419 Structural Behavior Laboratory 3 Credits
Experimental study of behavior of members, assemblages and structural systems. Introduction to methods and equipment used in laboratory simulations, numerical simulations, laboratory and in-situ measurements. Planning, executing and reporting experimental studies on performance of materials and large-scale structural systems. Non-destructive evaluation and damage assessment.
Prerequisites: CEE 262 and CEE 264

CEE 420 Surface Wave Mechanics 3 Credits
Elements of hydrodynamics and wave boundary conditions; linear wave theory and wave characteristics; nonlinear wave theories and application; wind wave generation, analysis and prediction; long waves; design wave determination; laboratory investigation of surface waves. Consent of instructor required.

CEE 424 Surface Water Hydrology 3 Credits
Advanced analysis and methods in surface water hydrology. Linear and non-linear hydrograph methods. Kinematic wave and other hydraulic routing techniques. Advanced techniques for evaporation, infiltration, and snow melt.
Prerequisites: CEE 320 or EES 320

CEE 425 Hydraulics of Sediment Transport 3 Credits
Hydrodynamic forces on particles, settling velocity. Sediment transport in open channel: tractive force theory, bed load and suspension theory, total load and wash load. Bedform mechanics, cohesive channel hydraulics. Sediment transport in closed conduits. Shore processes and coastline hydraulics.

CEE 426 GIS for Civil and Environmental Engineering 3 Credits
Introduction to theory, concepts and techniques related to the creation, manipulation, processing, and basic analysis of spatial data using geographical information systems (GIS) for real world engineering problems. Topics include: basic GIS concept, map projection and coordinate system, spatial data format and editing, spatial analysis, network analysis and developing simple GIS models. Multiple GIS tools are introduced. Lecture and laboratory.

CEE 427 Transport of Contaminants in Groundwater 3 Credits
Theory of groundwater flow and transport of contaminants in the groundwater system. State-of-the-art groundwater flow and contaminant transport models used to solve governing equations of groundwater flow and transport of chemically reactive solutes. Selected case studies will be analyzed.
Prerequisites: CEE 323 or EES 323

CEE 428 Advanced Topics in Hydraulics 1-3 Credits
Recent developments in hydromechanics and hydraulics. Topics to be selected from: wave mechanics, theory of flow through porous media, dispersion, hydrodynamic forces on structures, potential flow, free streamline theory, open channel hydraulics, computer methods. Consent of department required.
Repeat Status: Course may be repeated.
Prerequisites: CEE 322

CEE 429 Hydraulic Research 1-6 Credits
Individual research problems with reports.
Repeat Status: Course may be repeated.

CEE 431 Life-Cycle of Structural Systems 3 Credits
Assessing the life-cycle performance of new and existing structural systems, designing structures for lifetime performance, and optimizing the remaining life of existing structures, considering uncertainties in structural performance, demands placed on structural systems, structural maintenance and monitoring, and costs.

CEE 432 Structural Safety and Risk 3 Credits
Assessing safety and risk of structural systems during their specified service life, designing structures for specified safety and risk criteria for a prescribed service life, introducing Markov, queueing and availability models, statistics of extremes, time-variant safety and structural health monitoring, and optimal decision making under uncertainty based on single objective or multiple objectives.

CEE 433 Structural Optimization 3 Credits
Problem formulation, relative merit of various numerical optimization techniques, possible difficulties in applications, and how alternative formulations and methods can be combined to solve different design problems. Numerical optimization techniques are in general terms and their application to structural design.

CEE 436 Advanced Topics in Coastal Engineering 1-3 Credits
Advanced study of selected topics in coastal engineering such as: non-linear wave theory, design of coastal structures, shore protection and stabilization, numerical solution of coastal hydrodynamics. Selection of topics will depend on particular qualifications of staff, as well as on the interests of the students.
Repeat Status: Course may be repeated.

CEE 437 Interdependent Sustainable Urban Systems 3 Credits
Multidisciplinary application of modelling, optimization and control principles to interactive cyber-physical systems (CPSs) such as water, energy, transportation, and buildings. Analysis of complex urban systems, which are large-scale nonlinear civil systems composed of interconnected or interwoven parts. Topics include differential equation-based models of civil infrastructure systems; time and frequency domain representations; linear and non-linear model predictive control methods; dynamical behavior of the system; model analysis; and controllability. Students cannot receive credit for both CEE 337 and CEE 437.

CEE 439 Coastal Engineering Research 1-6 Credits
Individual research problems with reports.
Repeat Status: Course may be repeated.

CEE 440 Ground Improvement and Site Development 3 Credits
Soil stabilization; grouting and injection methods; preloading and dynamic consolidation; deep compaction; drainage and dewatering; application of geotextiles and geomembranes; soil nailing and reinforcement methods. Use of in-situ test for soil properties and site characterization; procedures and calibration methods for the basic in-situ tests - SPT, CPT, CPTU, DMT; theoretical, experimental and empirical interpretive methods for in-situ test results. Students will be required to complete an additional project. Students cannot receive credit for both 341 and 440.

CEE 441 Dynamic Analysis in Geotechnical Engineering 3 Credits
Vibration of elementary systems, 1D wave propagation, dynamic soil properties, analysis of response of shallow and deep foundations to dynamic loads, soil liquefaction and earthquake problems; laboratory tests, geophysical methods and non-destructive tests of foundation systems; dynamic analysis of pile driving. Consent of department chair.
Prerequisites: CEE 347

CEE 443 Advanced Soil Mechanics 3 Credits
Characterization of particulate media; particle-fluid interaction; load deformation, thermoelastic and viscoelastic behavior; elastic waves in particulate media; electromagnetic properties; empirical and analytical models. Must have completed a course in soil mechanics.

CEE 444 Behavior of Soils as Engineering Material 3 Credits
Soil mineralogy, bondage, crystal structure and surface characteristics; clay-water electrolyte system; soil fabric and its measurement; soil structure and physical property relationships; soil depositional and compositional characteristics; engineering properties of soils as they relate to soil mineralogy, fabric and composition: volume change behavior, intergranular stresses, shear strength and deformation behavior, conduction behavior, coupled and direct flow phenomena. Students will be required to complete an additional project. Students cannot receive credit for both CEE 344 and 444.

CEE 445 Advanced Foundation Engineering 3 Credits
Current theory and practice relating to the design of deep foundations supporting buildings and other structures. Construction practices; analysis and design {bearing capacity, settlement, dynamic effects}; site investigations; load-resistance-factor design (LRFD) criteria for foundations. This course, a version of CEE 340 for graduate students, requires advanced assignments. Credit will not be given for both CEE 340 and CEE 445.

CEE 446 Geotechnical and Environmental Applications of Geosynthetics 3 Credits
Fundamental and current theories of designing soil structures with geosynthetics. Waste containment systems; landfills, vertical barriers and slurry walls; erosion control; filtration and drainage systems; reinforced embankments and stabilized slopes. Design of select geotechnical facilities with geosynthetics that such as landfill, highway embankments, slopes and barrier systems. Term project. Students cannot receive credit for both 346 and 446.

CEE 447 Advanced Topics in Geotechnical Engineering 1-3 Credits
Advanced studies in selected subjects related to geotechnical engineering. The general areas may include: stress-strain-time relationships of soils, colloidal phenomena in soils, ground water flow and see page, soil dynamics, soil plasticity, numerical methods applied to soil mechanics, earth dam design, theories of layered systems and their application to pavement design, rock mechanics. The studies specifically undertaken in any particular semester depend on the availability of staff and the interest of students. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 448 Constitutive Laws in Soil Mechanics 3 Credits
Basic methods and constitutive laws used for the analysis of boundary value problems in soil mechanics. Linear elasticity, nonlinear elastic, linear elastic-perfectly plastic and non-linear elastoplastic models; critical state soil mechanics; application of select computational models. Consent of instructor required.

CEE 449 Geotechnical Research 1-6 Credits
Individual research problems relating to soil engineering, with report. Must have completed a course in soil mechanics.

CEE 450 Advanced Structural Analysis I 3 Credits
Theory and methods of linear and second order structural analysis. Linear theory and stiffness properties of structural members and linear transformations of structural analysis. Application of virtual work principles and development of displacement (stiffness) method of analysis in matrix form. Introduction to second order theory of structural members and second order equations of structural analysis.
Prerequisites: CEE 359 or CEE 359

CEE 452 Fatigue and Fracture of Structures - An Interdisciplinary View 3 Credits
This course examines the fatigue and fracture characteristics of steel structures from metallurgical, mechanical and structural engineering views. Both theory and experimental background are provided and applied to case studies and code development.

CEE 453 Nonlinear Analysis of Structural Components and Systems 3 Credits
Nonlinear analysis of structural components and systems, considering the effects of material and geometric nonlinearities. Solution strategies; material constitutive models; nonlinear member section analysis; computational plasticity; nonlinear beam-column element formulations; second order analysis; structural stability; and nonlinear time history analysis of structural dynamic systems.
Prerequisites: CEE 352 and CEE 404 and CEE 450

CEE 454 Sensors, Signals, and Systems 3 Credits
Characterization of sensing systems and analysis and processing of sensor data. Topics include formulation of signals in time and frequency domains: sampling, Nyquist theorem, interpolation, band-limited signals. Analysis of systems: LTI systems, convolution, Eigenfunctions, poles and zeros. Design and analysis of digital filters: ideal filters, FIR filters, filter behavior. Spectral analysis and system identification: stationary processes, power spectral density, frequency leakage. Fundamentals of sensing systems: piezoelectricity, actuation, measurement parameters. Students cannot receive credit for both CEE 354 and CEE 454.

CEE 455 Advanced Structural Dynamics 3 Credits
Analysis and design of structures to resist wind, earthquake, and blast loading. Matrix methods and computer applications. Non-linear and elasto-plastic response. Damping characteristics of structures and structural components, spectral analysis, dynamic instability. Characteristics of aerodynamic and seismic forces and explosions. Introduction to vibration of three-dimensional structural systems.
Prerequisites: CEE 352 or MECH 406

CEE 456 Behavior and Design of Earthquake Resistant Structures 3 Credits
Characteristics of earthquakes, effects of earthquakes on structures. Response of linear elastic structures to earthquakes. Response of inelastic structures to earthquakes. Behavior of structural components under cyclic loading. Principles of earthquake-resistant design. Seismic design procedures and their implementation in codes.
Prerequisites: CEE 352

CEE 457 Behavior and Design of Blast Resistant Structures 3 Credits
Design and assessment of structures subject to blast demands generated from accidental or intentional detonation of high explosives. Topics include determination of blast demands, characterization of pressure distributions on structural systems and components, estimation of the response of systems to dynamic pressure demands, modeling techniques for structural components, dynamic time history analysis of systems, determination of allowable response limits and stand-off requirements for facilities, and design structures to resist the effects of close-in detonation of high explosives and the impact of ballistic fragments.

CEE 458 Random Vibrations 3 Credits
Review of probability theory. General characterization and models of random functions for engineering applications (seismic ground motion, wind velocity, ocean waves, mechanical vibrations). Vibration of deterministic systems under random dynamic loads; applications to wind and seismic engineering. Uncertain systems under random perturbations, simulation of random functions for numerical solutions (non-stationary, non-Gaussian, multi-variate processes, multi-dimensional fields). Students cannot receive credit for both CEE 358 and CEE 458.
Prerequisites: CEE 352

CEE 459 Advanced Topics in Plastic Theory 3 Credits
Fundamentals of the mathematical theory of plasticity; the general theorems of limit analysis and their applications to beams under combined loading, arches, space frames, plates and shells. Limit analysis of two- and three-dimensional problems in soil, concrete, rock, and metal. Current developments.
Prerequisites: CEE 404

CEE 461 Advanced Bridge Engineering 3 Credits
Students in CEE 461 cover the same topics described under CEE 361, but in more depth. In addition each student conducts an intensive study of a bridge-related topic of his or her choice. A short written technical report on the findings of this study is required.
Prerequisites: CEE 262 and CEE 264

CEE 462 Stability of Structural Systems 3 Credits
Stability analysis of structures systems, including moment-resisting and braced frames, trusses, and plate and box girders. Bracing requirements. Elastic and inelastic second-order analysis. Design considerations. Special topics.
Prerequisites: CEE 404

CEE 463 Advanced Mechanics of Reinforced Concrete 3 Credits
Consistent mechanics for the design of reinforced concrete with or without prestress. Limit theorems of the theory of plasticity and their application to beams, slabs, and disturbed regions. Applications may include beams in flexure and combined flexure, axial load, and torsion; slabs (strip method, yield line analysis); corbels, deep beams, and other disturbed regions (truss models, strut-and-tie models, and associated failure mechanisms).
Prerequisites: CEE 404

CEE 464 Condition Assessment of Existing Structures 3 Credits
Assessment of existing structures for strength and serviceability. Materials evaluation and testing. Overview of material degradation mechanisms. Nondestructive and destructive evaluation test methods. Basics of field instrumentation. Load tests. Planning condition assessment programs. Focus on steel, concrete and masonry structures. Presentation of case studies including buildings, bridges, foundations, dams, tunnels and other structures. May include some laboratory and / or field work.

CEE 465 Structural Fire Engineering 3 Credits
Design and assessment of structural systems subjected to fire. Emphasizes a 3-phase approach to structural-fire engineering: (1) fire modeling, (2) heat transfer modeling, and (3) structural modeling. Includes approaches to simulate combustion and heat release for indoor and outdoor fires. Heat transfer modeling focuses on calculating the temperature increase of fire-exposed structural elements. Mechanics of structural elements and assemblies consider thermal expansion and weakening due to increasing temperature. Design approaches to mitigate the effects of fire are introduced.

CEE 466 Advanced Finite Element Methods 3 Credits
Review of linear elastic Finite Element (FE) method and weak formulation of equilibrium. Implementation of a liner elastic FE code. Special topics including shear locking, reduced integration, non-homogeneous essential conditions, and imposed strains. Dynamic FE analysis: theory and implementation of modal and time-history analyses. Techniques to model structural masses and damping. Stochastic FE analysis: theory and implementation of methods to analyze uncertain structures. Examples using scientific and commercial software to highlight practical modeling issues. Lab-sessions and student projects are included.
Prerequisites: CEE 366

CEE 467 Advanced Topics in Structural Engineering 1-3 Credits
Advanced study of selected topics in structural mechanics and engineering, such as: finite element methods, suspension system; space frames; stability of nonlinear systems; coldformed and lightweight construction; optimization and reliability; second-order phenomena in structures; interaction of structures with the environment; structural use of plastics; composite construction, etc. Selection of topics will depend on particular qualifications of the staff, as well as on the interests of the students. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 468 Stability of Elastic Structures 3 Credits
Basic concepts of instability of a structure; bifurcation, energy increment, snap-through, dynamic instability. Analytical and numerical methods of finding buckling loads of columns. Postbuckling deformations of cantilever column. Dynamic buckling with nonconservative forces. Effects of initial imperfections. Inelastic buckling. Buckling by torsion and flexure. Variational methods. Buckling of frames. Instability problems of thin plates and shells.
Prerequisites: MATH 205

CEE 470 Reaction Kinetics in Environmental Engineering 3 Credits
Theory of reaction kinetics and its application to the design and operation of chemical, physico-chemical and biological reactors in water and wastewater treatment. Basic design equations for various types of reactors and migration of pollutants in the environment. Students cannot receive credit for both CEE 371 and CEE 470.

CEE 471 Environmental Risk Assessment 3 Credits
Effects of chemical releases on human health; ecological risks. Application of risk assessment methodology, including hazard identification, exposure assessment, toxicity assessment, and risk characterization. Accounting for uncertainty in data during risk management, risk reduction and implementation of regulations and environmental policy. Term project.

CEE 472 Water and Wastewater Treatment Facilities 3 Credits
Theory and design of water and wastewater treatment facilities. Physical, chemical, and biological treatment processes for water and wastewater treatment.
Prerequisites: CEE 375 or CHE 375

CEE 473 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes. Students cannot receive credit for both CEE 473 and CEE 370.
Prerequisites: CEE 470

CEE 474 Aquatic Chemistry 3 Credits
Applying basic principles of aqueous chemistry for quantifying complex, environmental systems. Specific examples of air-water-soil interactions and consequent effects. Heterogeneous equilibria with more than one solid phase. Kinetics and thermodynamics of some important ionic and biological reactions.

CEE 475 Advanced Topics in Environmental Engineering 1-3 Credits
Advanced concentrated study of a selected topic in environmental engineering such as non-point source pollution control, water reuse systems, new concepts in treatment technology, toxic substance control, etc. The instructor and student select topic. s may include specialized laboratory research, literature review, and specialty conference attendance. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 476 Environmental Biotechnology 3 Credits
Fundamentals of microbiology and biochemistry applied to natural and engineered environmental systems. Systems ecology, energetics and kinetics of microbial growth, nutrition and toxicology, use of microorganisms for pollution monitoring and control. Pathogenicity and disease transmission, water quality using biological indices. Students cannot receive credit for both CEE 376 and 476.
Prerequisites: CEE 375 or CHE 375

CEE 477 Environmental Engineering Processes 3 Credits
Processed applied in environmental engineering for air pollution control, treatment of drinking water, municipal wastewater, industrial wastes and environmental remediation. Kinetics, reactor theory, mass balances, application of fundamental physical, chemical and biological principles to analysis and design. Students cannot receive credit for both CEE 375 and 477.
Prerequisites: CEE 170

CEE 478 Toxic and Hazardous Wastes 3 Credits
Regulations for collection, transportation, disposal and storage of hazardous wastes. Containment systems, monitoring, types of liners, new and available technologies to eliminate or recover the hazardous components of the wastes. Students cannot receive credit for both CEE 378 and CEE 478.
Prerequisites: CEE 274 or CEE 375 or CHE 375

CEE 479 Environmental Engineering Research 1-6 Credits
Individual research problems in environmental engineering with report.
Repeat Status: Course may be repeated.

CEE 480 Independent Study 1-3 Credits
An intensive study of one or more areas of civil and environmental engineering that is not normally covered in other courses. Consent of instructor is required. A written report may be required.
Repeat Status: Course may be repeated.

CEE 481 MS or MEng Project 1-6 Credits
A design project or focused study of a problem related to civil and environmental engineering. May be used in lieu of CEE 491. A written report is required. Consent of the instructor is required.
Repeat Status: Course may be repeated.

CEE 484 Advanced Environmental Chemistry 3 Credits
Environmental organic chemical classifications, chemical partitioning between phases (air-water, air-organic, and multi-phase partitioning), Linear Free Energy Relationships (LFER), sorption isotherms, organic chemical partitioning in living media, transformation reactions, and modeling of organic chemical transport with reactions. Graduate version of the course includes projects on advanced topics (e.g., dynamic properties of multidimensional models, photochemistry, reaction pathways, kinetics of redox reactions). Students cannot receive credit for both CEE 384 and CEE 484.

CEE 491 Thesis 1-6 Credits

CEE 499 Dissertation 1-15 Credits

Civil and Environmental Engineering and Earth and Environmental Sciences

This program is designed for students interested in combining programs in two departments: Civil & Environmental Engineering and Earth & Environmental Science, leading to two bachelor of science degrees, one in Civil Engineering or Environmental Engineering and the other in Earth and Environmental Sciences. Both degrees would be awarded at the end of the fifth year. This program is one of the dual degree programs mentioned in the Five-Year Programs section. The student will have a primary advisor in the P.C. Rossin College of Engineering and Applied Sciences and a secondary advisor in the Arts and Sciences College. The program provides alternatives for students who may decide not to complete the dual-degree program. Students who make this decision prior to the beginning of the fourth year may qualify at the end of that year for the bachelor of science in civil or environmental engineering, as well as a minor in earth and environmental sciences. Also, if a student decides after two years to pursue only a bachelor of science degree in the EES department, it is possible to complete the requirements in four years. If the decision to work toward this degree is made during the fourth year, at least one additional semester is required to qualify for either B.S. degree. Interested students should consult with the respective departmental advisors to create a schedule of courses to resolve conflicts or if a specified course is not offered that semester. Required courses and major electives for the different EES B.S. degree programs are listed in the catalog entry for EES. Cross-listed EES/CEE courses used to satisfy Civil Engineering Approved Electives can reduce the individual semester and total program credits when chosen to satisfy EES program requirements. Additional useful information can be found on the web sites (www.lehigh.edu/~incee/ (http://www.lehigh.edu/~incee/) and www.ees.lehigh.edu (http://www.ees.lehigh.edu)).

REQUIRED COURSES FOR B.S. IN EARTH AND ENVIRONMENTAL SCIENCES AND B.S. IN CIVIL ENGINEERING

Recommended Sequence of Courses

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible.

A total of 173 credit hours are needed to meet the requirements for both degrees. The total required credits may vary if elective credits are used to jointly satisfy CEE Approved Elective/EES 100-300 Elective requirements by using CEE/EES cross-listed courses[3].

First Year

First Semester	CR	Second Semester	CR
WRT 001	3	WRT 002	3
MATH 021	4	MATH 022	4
CHM 030	4	ENGR 010	2
ENGR 005	2	PHY 011 & PHY 012	5
ECO 001	4	HSS Humanities/ Social Science Elective	3
	17		**17**

Second Year

First Semester	CR	Second Semester	CR
MATH 023	4	PHY 021 & PHY 022	5
CEE 003	3	CEE 059	3
CEE 010	3	EES 080	4
CEE 011	1	MATH 205	3
CEE 012	2	CHM 031	4
EES Gateway Elective	3		
EES 022	1		
	17		**19**

Third Year

First Semester	CR	Second Semester	CR
CEE 122	0,3	CEE 123	3
CEE 142	3	CEE 170	4
HSS Humanities/ Social Sciences Elective	4	CEE 242	3
EES 100-300 Level Elective[5]	4	CEE 222	3

		EES 100-300 Level Elective[5]	4	EES 200	4
			15-18		**17**

Fourth Year

Summer	CR	First Semester	CR	Second Semester	CR
EES Field Experience[6]		CEE 159	4	CEE 117	2
		EES 100-300 Level Elective[5]	4	CEE 202	3
		EES 100-300 Level Elective[5]	4	CEE 262 or 264	3
		EES 100-300 Level Elective[5]	4	AE CEE Civil Engineering Approved Elective[3]	3
				BSE Basic Science Elective[2]	3
				EES 100-300 Level Elective[5]	4
	0		**16**		**18**

Fifth Year

	First Semester	CR	Second Semester	CR
	CEE 203	2	AE CEE Civil Engineering Approved Electives[3]	7
	AE CEE Civil Engineering Approved Elective [3]	3	CEE 290[4]	3
	HSS Humanities/ Social Sciences Elective	3	HSS Humanities/ Social Sciences Electives	3
	EES 380	1	EES 100-300 Level Elective[5]	4
	EES 100-300 Level Elective[5]	4		
	EES 100-300 Level Elective[5]	4		
		17		**17**

Total Credits: 170-173

2

BSE Basic Science Elective. List of courses is available from CEE Department.

3

CHM 031 plus thirteen additional credits of CEE Approved Electives are required; list available from CEE department: that includes five CEE/EES cross-listed courses: CEE 316 (EES 316), CEE 320 (EES 320), CEE 323 (EES 323), CEE 327 (EES 327), and CEE 379 (EES 379).

4

Usually CEE 290, but can be a multidisciplinary teaming version of CEE 205, CEE 377 or CEE 381.

5

At least four of the EES electives must be at the 300 level. Up to 8 credits of EES internship (EES 093, EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 093/EES 293).

6

For more information on the EES field requirement see the EES catalog entry (p. 119).

REQUIRED COURSES FOR B.S. IN EARTH AND ENVIRONMENTAL SCIENCES AND B.S. IN ENVIRONMENTAL ENGINEERING

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible. Three of these HSS credits must be an approved course that meets the Environmental Studies Requirement.

Recommended Sequence of Courses

A total of 173 credit hours are needed to meet the requirements for both degrees. The total required credits may vary as some CEE and EES requirements can be simultaneously satisfied by taking CEE course that are cross-listed with EES courses.

First Year

	First Semester	CR	Second Semester	CR
	WRT 001	3	WRT 002	3
	MATH 021	4	MATH 022	4
	CHM 030	4	PHY 011 & PHY 012	5
	ENGR 005	2	ENGR 010	2
	HSS Humanities/ Social Science Elective	3	EES Gateway Elective	3
		16		**17**

Second Year

	First Semester	CR	Second Semester	CR
	MATH 023	4	PHY 021 & PHY 022	5
	CEE 003, MECH 002, or MECH 003	3	MATH 205	3
	CEE 012	2	CEE 170	4
	CHM 031	4	CEE 272	2
	EES 022	1	EES 080	4
	HSS Humanities/ Social Sciences Elective	3		
		17		**18**

Third Year

	First Semester	CR	Second Semester	CR
	CHM 110	3	CEE 274	3
	CHM 111	1	EES 200	4
	CEE 375	3	ECO 001	4
	CHE 031	3	ESR Earth Science Requirement[3]	3
	EES 100-300 Level Elective[5]	4	EES 100-300 Level Elective[5]	4
	EES 100-300 Level Elective[5]	4		
		18		**18**

Fourth Year

Summer	CR	First Semester	CR	Second Semester	CR
EES Field Requirement[6]		CEE 122	3	CEE 202	3
		CEE 142	3	CEE 222	3
		CEE 378	3	CEE 275	2
		EES 100-300 Level Elective[5]	4	CEE Approved Elective[2]	3
		EES 100-300 Level Elective[5]	4	EBR Environmental Biology Requirement[4]	3

			EES 100-300 Level Elective	4
	0	17		18

Fifth Year

First Semester	CR	Second Semester	CR
CEE 203	2	CEE 377	3
EES 380	1	CEE Approved electives[2]	3
CEE Approved electives[2]	6	HSS Humanities/ Social Sciences Electives	3
EES 100-300 Level Elective[5]	4	EES 100-300 Level Elective[5]	4
HSS Humanities/ Social Sciences Electives[1]	4	EES 100-300 Level Elective	4
	17		17

Total Credits: 173

1

HSS advanced requirement is 13 credits, three credits of which must be an approved course that meets the Environmental Studies Requirement; the list of approved courses is available from CEE department.

2

12 approved elective credits to satisfy proficiency in four focus areas of water supply and resources, environmental chemistry, waste management and biological processes; approved list available from CEE department.

3

Earth Science Requirement, list of approved courses are available from CEE department.

4

Environmental Biology Requirement, list of approved courses are available from CEE department.

5

At least four of the EES electives must be at the 300 level. Up to 8 credits of EES internship (EES 093, EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 093/EES 293).

6

For more information on the EES field requirement see the EES catalog entry (p. 119).

Computer Engineering

Website: https://engineering.lehigh.edu/ece **(**https://engineering.lehigh.edu/ece/**)**

Computer Engineering deals with the design and analysis of intelligent systems that have become indispensable in today's world and it requires expertise in both hardware and software areas. The Computer Engineering program is offered by the department of Electrical and Computer Engineering (ECE).

Most courses in the Computer Engineering curriculum are listed in the Computer Science and Engineering (p. 435) (CSE) and Electrical and Computer Engineering (p. 449) (ECE) departments.

UNDERGRADUATE PROGRAMS

Mission Statement

The mission of the computer engineering program is to prepare computer engineers to meet the challenges of the future; to promote a sense of scholarship, leadership and service among our graduates; to instill in the students the desire to create, develop, and disseminate new knowledge; and to provide international leadership to the computer engineering profession.

Program Educational Objectives in Computer Engineering

The objective of the Computer Engineering program is to produce students who within 5-10 years after graduation will:

- be valued as technically proficient computer engineers in related industries or will be able to successfully pursue advanced degrees
- engage in life-long learning and professional development to advance their knowledge and skills
- communicate effectively, perform well both independently and collaboratively, exhibit high levels of professionalism and ethical responsibility, and demonstrate leadership in their chosen profession and communities

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

The required courses for this degree include the fundamentals of electronic circuits, signal theory, logic design, computer architecture, digital systems, structured programming, data structures, software engineering, operating systems and discrete mathematics. A strong foundation in the physical sciences and in mathematics is required. Approved technical electives, chosen with the advisor's consent, are selected in preparation for graduate study or entry into industry according to individual interests.

The program totals 130 credit hours. The Computer Engineering program is accredited by the Engineering Commission of ABET, www.ABET.org.

The recommended sequence of courses follows:

First Year

First Semester	Credits	Second Semester	Credits
MATH 021	4	MATH 022	4
WRT 001	3	WRT 002	3
ENGR 005	2	ECO 001 or ELE[3]	4
Select one of the following	5-6	Select one of the following	5-6
CHM 030 & ENGR 010[1]	-	CHM 030 & ENGR 010[1]	-
PHY 011 & PHY 012[1]	-	PHY 011 & PHY 012[1]	-
	14-15		**16-17**

Second Year

First Semester	Credits	Second Semester	Credits
ECE 033	4	ECE 108	4
ECE 081	4	ECE 123	3
PHY 021 & PHY 022	5	ECE 201	3
MATH 023	4	CSE 007	4
		ECO 001 or ELE[3]	4
	17		**18**

Third Year

First Semester	Credits	Second Semester	Credits
ECE 128	3	ECE 132	3
ECE 200	1	CSE 109	4
CSE 017	3	CSE 140	3
MATH 205	3	Free Elective	3
MATH 231 or 309	3	HSS Elective[3]	3
Free elective	3		
	16		**16**

Fourth Year

First Semester	Credits	Second Semester	Credits
ECE 257	3	ECE 258	2

CSE 216	3	Approved technical electives[2]	9
CSE 303	3	HSS elective[3]	4
HSS elective[3]	3-4	Free Elective	3
Approved Technical Elective[2]	3		
	15-16		**18**

Total Credits: 130-133

1

Required natural science courses, one taken fall semester and the other taken in spring

2

Approved technical electives (12 credits) are subjects in the area of science and technology. Except for one elective, they are restricted to the offerings in the ECE and CSE departments. One elective must be an engineering science elective from a department other than ECE and CSE. CSE 042 and CSE 252 are not approved technical electives.

3

Distribution of HSS courses must satisfy the college requirements.

MINOR IN COMPUTER ENGINEERING

Required Courses		
ECE 033	Introduction to Computer Engineering	4
ECE 128	FPGA Laboratory	3
ECE 132	Microcontroller Laboratory	3
ECE 201	Computer Architecture	3
Elective Options: Pick One		3
ECE 303	Accelerated Computing for Deep Learning	
ECE 306	Autonomous Driving and Robotic Racing	
ECE 318	INTRODUCTION TO INTERNET OF THINGS	
ECE 319	Digital System Design	
ECE 336	Embedded Systems	
ECE 361	Introduction to VLSI Circuits	
ECE 363	Computer-Aided Design of Digital Systems	
ECE 401	Advanced Computer Architecture	
ECE 416	VLSI Signal Processing	
Other relevant ECE or CSE courses by petition to the Associate Chair of the ECE Department		
Total Credits		**16**

Because of similar course requirements between electrical and computer engineering, electrical engineering students must complete the four required courses plus two courses from the elective options specified in the list above. Electrical engineering technical electives (chosen from the above list) can be used to satisfy the requirements of the minor.

Technical minors must be declared by the end of pre-registration of the student's sixth semester. If course requirements change or a student wishes to vary the list of courses above, a revised minor declaration form must be submitted.

GRADUATE PROGRAMS

Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student's professional goals. The programs appeal to individuals with backgrounds in computer or information science, in computer engineering, in electrical engineering, in mathematics, or in the physical science. Research is an essential part of the graduate program. The research topics are listed in the departmental descriptions for Computer Science and Engineering (CSE) and Electrical and Computer Engineering (ECE). Individual courses are listed in the catalog descriptions of the CSE and ECE departments.

The Master of Science degree requires the completion of 30 credit hours of work and may include a six credit hour thesis for Computer Engineering degree. A program of study must be submitted in compliance with the graduate school regulations.

The Master of Engineering degree requires the completion of 30 credit hours of work and may include up to six credits of independent study. A program of study must be submitted in compliance with the graduate school regulations.

The Ph.D. degree in computer engineering requires the completion of 42 credit hours of work (including the dissertation) beyond the master's degree (48 hours if the master's degree is not from Lehigh), the passing of a departmental qualifying examination appropriate to each degree within one year after entrance into the degree program, the passing of a general examination in the candidate's area of specialization, the admission into candidacy, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The program has a core curriculum requirement for graduate students. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the program acquire an appropriate breadth of knowledge of their discipline. Please see the ECE department website for degree requirements.

Courses from other universities or undergraduate studies may be used to satisfy these requirements, by petition, at the discretion of the program faculty. Additional graduate program information may be obtained from the program's graduate coordinator.

Computer Science and Engineering

The Department of Computer Science and Engineering (CSE) offers undergraduate and graduate programs of study in Computer Science , Computer Science and Business, and Data Science, along with research opportunities in these fields. Computer science, the core of includes the study of computer algorithms, software systems, and the effective use of computers to solve real-world problems and develop new applications. Lehigh's majors prepare students for a wide range of professions in the technology industry, a well as in other sectors that rely on computer systems and technology. According the to the U.S. Bureau of Labor and Statistics (2023), "employment of computer and information research scientists is projected to grow 21 percent from 2021 to 2031, much faster than the average for all occupations". More discussion on the potential of computer science -related careers, as well as the most up to date course offerings and department faculty can be found on our departmental web site, engineering.lehigh.edu/cse (https://engineering.lehigh.edu/cse/).

At the undergraduate level, Lehigh University offers a Bachelor of Science degree in Computer Science from the P. C. Rossin College of Engineering and Applied Science; the Bachelor of Science degree in Computer Science, and the Bachelor of Arts degree with a major in Computer Science, from the College of Arts and Sciences; and a Bachelor of Science in Computer Science and Business, jointly supported by the P.C. Rossin College of Engineering and Applied Science and the College of Business. A minor in Computer Science is available, except to students majoring in Computer Engineering, Computer Science or Computer Science and Business. A minor in Data Science is available to undergraduates in any major. Graduate study in the department leads to the degrees of Master of Science and Doctor of Philosophy (Ph.D.) in Computer Science. The CSE department also partners with the College of Business to offer the Bachelor of Science degree in Integrated Business and Engineering and the Masters of Business and Engineering (MB&E) program.

The undergraduate programs emphasize the fundamental aspects of their respective areas, with extensive hands-on experiences for the students. Electives permit students to tailor their programs according to their interests and goals, whether they be in preparation for graduate study or careers in industry. Students have the opportunity to synthesize and apply their knowledge in a capstone project. Students are encouraged to become involved in the many research projects within the department- and may use independent study

courses and their capstone project as a way to participate while receiving course credit.

The graduate programs enable students to deepen their professional knowledge, understanding, and capability within their sub-specialties. Each graduate student develops a program of study in consultation with his or her graduate advisor. Key thrust areas in the department include:

Computer Systems Engineering: computer architecture, sensor networks, robotics, mobile and wearable computing, and networking.

Software Systems Engineering: software architectures, parallel and distributed computing, object-oriented software, middleware, Web-based systems and networked software systems.

Information Systems Engineering: database, data mining, bioinformatics, computer graphics, optimization, multimedia systems, expert systems, artificial intelligence, and computer vision.

The department maintains several computer laboratories to support student learning and collaboration. The department has research laboratories in robotics, networking, image processing, artificial intelligence, parallel computing, security, and web mining. These laboratories and their associated research activities are described more completely in the departmental web site, engineering.lehigh.edu/cse (https://engineering.lehigh.edu/cse/). While these laboratories are research-oriented, they are also used for undergraduate projects.

Computer laboratory usage is an essential part of the student's education. Primary CSE department resources include a network of more than 60 workstations, file and general servers, and GPU computer servers primarily running the Linux operating system. These systems provide an array of software tools for students and researchers including programming languages (C, C++, Java, Python, Rust, Go, Perl, Ruby, Matlab, etc.), software development tools, software and hardware simulators, and computer-aided design packages. The teaching labs provide workstations that are specifically designed for flexibility in running different operating systems and environments. The systems also offer a controlled software footprint that allows course materials to be crafted with exacting specifications of the environment offering rich and immersive experiences for students. Students will learn about networking and network security, operating systems, high-performance computing, parallel processing, and system administration.

The CSE department's computers are connected via gigabit Ethernet to the university's backbone network. The university is connected through multiple high-capacity connections to the Internet as well as a connection to Internet2. The department embraces the 'Bring Your Own Device' movement In addition to departmental resources, the university provides campus-wide wireless network access, public sites containing hundreds of PCs and Macs, multiple large-capacity computer servers, and classrooms equipped with advanced technology that fosters collaborative learning.

UNDERGRADUATE PROGRAMS IN COMPUTER SCIENCE ARE AVAILABLE IN BOTH THE COLLEGE OF ENGINEERING AND THE COLLEGE OF ARTS AND SCIENCES. PLEASE SEE BELOW FOR MORE INFORMATION.

UNDERGRADUATE PROGRAMS

Mission Statement for the Computer Science and Engineering Programs

The mission of the Computer Science and Computer Science and Business programs is to prepare computer scientists to meet the challenges of the future; to promote a sense of scholarship, leadership and service among our graduates; to instill in the students the desire to create, develop, and disseminate new knowledge; and to provide international leadership to the Computer Science, Computer Engineering, and Business professions.

Program Educational Objectives in Computer Science

Graduates of the Bachelor of Science in Computer Science Programs will:

- Apply their education in Computer Science to the analysis and solution of scientific, business, and industrial problems.
- Account for ethical and social issues when solving scientific, business, and industrial problems.
- Function effectively in a collaborative team and effectively communicate with members of the team.
- Engage in continued education in their field of expertise.
- Attain positions of expertise in their chosen field.

Student Outcomes

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]

BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BUSINESS

See catalog entry for Computer Science and Business (p. 492).

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Bachelor of Science in Computer Science degree programs are available to students through either the College of Arts and Sciences or the P. C. Rossin College of Engineering and Applied Science. Both programs are accredited by the Computing Accreditation Commission of ABET (http://www.abet.org/). The two programs are identical in the fundamental requirements in Mathematics and Computer Science, and the programs are appropriate for entry into technical or management positions. They are also appropriate for continued graduate study; students considering graduate study are strongly encouraged to consider taking part in a research project during their junior year. The two BS programs differ in their non-Computer Science content: The students must fulfill the distribution requirements of the respective college.

The required courses for the degrees contain the fundamentals of discrete mathematics, structured programming, algorithms, computer architecture, compiler design, operating systems, and programming languages. A strong foundation in mathematics is required. Because many courses are frequently offered, there are many sequences in which courses may be taken to satisfy the requirements. Below are the requirements for the B.S. degrees. See engineering.lehigh.edu/cse (https://engineering.lehigh.edu/cse/) for links to sample sequences and for a list of all CSE courses, their prerequisites, and when they are offered.

P. C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Bachelor of Science in Computer Science

Total required credit hours: 130

Required Computer Science courses

CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	4
or CSE 007	Introduction to Programming	
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 202	Computer Organization and Architecture	3
CSE 216	Software Engineering	3
CSE 262	Programming Languages	3
CSE 140	Foundations of Discrete Structures and Algorithms	3
CSE 280	Capstone Project I	3
CSE 281	Capstone Project II	3
CSE 303	Operating System Design	3
CSE 340	Design and Analysis of Algorithms	3

Required Math and Science courses		
CHM 030	Introduction to Chemical Principles	4
ENGR 010	Applied Engineering Computer Methods	2
ENGR 005	Introduction to Engineering Practice	2
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
MATH 231	Probability and Statistics	3
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	5
Required approved electives [1]		
Technical electives: Any CSE course of 200-level or above unless explicitly excluded by the department		15
Science and technology courses, chosen by the student with the approval of the student's advisor		6
Humanities and Social Science (HSS) requirements		
ECO 001	Principles of Economics	4
WRT 001	Academic and Analytical Writing	3
WRT 002	Research and Argument	3
CSE 252	Computers, the Internet, and Society	3
HSS courses that satisfy the Engineering College "breadth and depth" requirements		17
Electives		
Free Electives		8
Total Credits		**130**

1

The department highly recommends that students give focus to their approved electives by following one of the tracks listed in the department website at www.cse.lehigh.edu/TRACKS (http://www.cse.lehigh.edu/TRACKS/)

COLLEGE OF ARTS AND SCIENCES

Bachelor of Science in Computer Science

See the distribution requirements (p. 60) of the College of Arts and Sciences.

Required Computer Science courses		
CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	4
or CSE 007	Introduction to Programming	
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 202	Computer Organization and Architecture	3
CSE 216	Software Engineering	3
CSE 262	Programming Languages	3
CSE 140	Foundations of Discrete Structures and Algorithms	3
CSE 280	Capstone Project I	3
CSE 281	Capstone Project II	3
CSE 303	Operating System Design	3
CSE 340	Design and Analysis of Algorithms	3
Required Math and Science courses		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
MATH 231	Probability and Statistics	3
Natural science course [1]		12
Required approved electives [2]		
Technical electives: Any CSE course of 200-level or above unless explicitly excluded by the department		15
Science and technology courses, chosen by the student with the approval of the student's advisor		6
Humanities and Social Science (HSS) requirements		
CSE 252	Computers, the Internet, and Society	3
WRT 001	Academic and Analytical Writing	3
WRT 002	Research and Argument	3
HSS courses that satisfy the Arts and Sciences College distribution requirements		21
Electives		
Free Electives		11
Total Credits		**127**

1

Twelve credit hours of natural science, such that one course has an attached laboratory and such that two courses are in a laboratory science with the first course a prerequisite to the second course.

2

The department highly recommends that students give focus to their approved electives by following one of the tracks listed in the department website at www.cse.lehigh.edu/TRACKS (http://www.cse.lehigh.edu/TRACKS/).

COLLEGE OF ARTS AND SCIENCES

Bachelor of Arts in Computer Science

This program of 120 credit hours is intended for students who desire a strong liberal arts program with a concentration in computer science. The program contains the fundamentals of computer science, including algorithms, structured programming, data structures, programming languages, and software engineering.

The requirements of the major are listed below. For a suggested sequence of courses to satisfy this major and for a list of all CSE courses, their prerequisites, and when they are offered, see www.cse.lehigh.edu/COURSES. The distribution requirements of the College of Arts and Sciences appear in the College section of the catalog.

Total required credit hours: 120

Required Computer Science courses		
CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	4
or CSE 007	Introduction to Programming	
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 216	Software Engineering	3
CSE 262	Programming Languages	3
CSE 140	Foundations of Discrete Structures and Algorithms	3
CSE 340	Design and Analysis of Algorithms	3
Required Math and Science courses		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 043	Survey of Linear Algebra	3
or MATH 205	Linear Methods	
or MATH 242	Linear Algebra	
Technical electives: Any CSE course of 200-level or above except CSE 252 and any other course explicitly excluded by the department [1]		12
Total Credits		**46**

1

The department highly recommends that students give focus to their approved electives by following one of the tracks listed in the department website at www.cse.lehigh.edu/TRACKS (http://www.cse.lehigh.edu/TRACKS/)

MINOR IN COMPUTER SCIENCE

The minor in computer science provides a basic familiarity with software development and programming, computer organization, and essential elements of computer science. This minor is not available to students majoring in Computer Engineering, Computer Science and Computer Science and Business. The minor requires 16 credit hours, consisting of the following:

CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	4
or CSE 007	Introduction to Programming	
CSE 017	Programming and Data Structures	3
CSE courses at the 100 level or higher (not including CSE 252)		3
CSE courses at the 200 level or higher (not including CSE 252)		6
Total Credits		**16**

MINOR IN DATA SCIENCE

Virtually every discipline collects data to gain a deeper understanding of their discipline and to make better decisions. The technical challenges associated with collecting, storing, processing, communicating, visualizing, analyzing, and interpreting the huge quantities of data that have become available today are far from trivial. The courses of the minor in Data Science help prepare students to develop computational solutions to analyze data and provide insights of value.

The minor is open to undergraduates from all colleges, and requires a minimum of 16 credit hours, consisting of the following:

Three required courses (10-11 credits)

CSE 160	Introduction to Data Science	3
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	
MATH 312	Statistical Computing and Applications	4
Total Credits		**10**

One approved applied data mining / analytics course at the 200/300 level (3 credits)

CSE 326	Fundamentals of Machine Learning	3
CSE 347	Data Mining	3
ISE 364	Introduction to Machine Learning	3
MKT 325	Consumer Insights through Data Analysis	3
MKT 326	Marketing Analytics and Artificial Intelligence in the Digital Space	3
BUAN 348	Predictive Analytics in Business	3
ECO 325	Consumer Insights through Data Analysis	3
ECO 360	Time Series Analysis	3

The director may approve additional applied data mining / analytics courses.

One or more approved electives related to data science including, but not limited to an additional applied data mining/analytics course from above, or the following (3-4 credits)

CSE 241	Database Systems and Applications	3
CSE 341	Database Systems, Algorithms, and Applications	3
CSE 327	Artificial Intelligence Theory and Practice	3
CSE 337	Reinforcement Learning	3
CSE 345	WWW Search Engines	3
CSE 375	Principles of Practice of Parallel Computing	3
ISE 111	Engineering Probability	3
ISE 121	Applied Engineering Statistics	3
ISE 224	Information Systems Analysis and Design	3
MATH 043	Survey of Linear Algebra	3
MATH 205	Linear Methods	3
MATH 242	Linear Algebra	3-4
STAT 342	Applied Linear Algebra	3
MATH 309	Probability with Applications and Simulations	3
MATH 334	Mathematical Statistics	3,4
BIS 324	Business Data Management	3
ECO 357	Econometrics	3
ECO 367	Applied Microeconometrics	3

The program director may approve additional data science-related electives.

Many of the courses that apply to the minor have prerequisites. These prerequisites do not count toward the minor, and students attempting to complete the minor are not recused from these prerequisites.

P. C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Graduate Programs

Note: For information about graduate degrees in Computer Engineering, see the catalog entry for Computer Engineering. *(*p. 434*)*

Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student's professional goals. The programs appeal to individuals with backgrounds in Computer or Information Science, Computer Engineering, Electrical Engineering, Mathematics, or the Physical Sciences. Research is an essential part of the PhD program, and an option in the Masters programs.

The Master of Science degree requires the completion of 30 credit hours of work and may include a three credit hour thesis. A program of study must be submitted in compliance with the graduate school regulations. An oral presentation of the thesis is required.

The Master of Engineering degree requires the completion of 30 credit hours of work, which includes design-oriented courses and an engineering project. A program of study must be submitted in compliance with the college rules. An oral presentation of the project is required.

The PhD degree in computer science requires the completion of 42 credit hours of work (including the dissertation) beyond the master's degree (48 hours if the master's degree is not from Lehigh), the passing of departmental qualifying qualifying examination, the passing of a general examination in the candidate's area of specialization, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The PhD program has a "Core" curriculum requirement for all students: CSE 406 Research Methods, CSE 411 Advanced Programming Techniques, and CSE 440 Advanced Algorithms. These core courses ensure that all students pursuing a PhD in the department obtain fundamental skills necessary to conduct computer science research. The three core courses must be completed during the first year.

In addition to the three required core courses, Computer Science PhD students must also satisfy a "Breadth" requirement, which involves taking at least one (1) graduate course at the 400-level in at least three (3) of the following breadth areas: Artificial Intelligence and Data Science; Robotics and Computer Vision; Systems, Hardware and Networking; and/or Interdisciplinary Applications. Completing these breadth courses helps familiarize students with advanced topics

in a range of different subdomains across computer science. This breadth will help students to collaborate with others who specialize in a different area than their own.

Breadth courses appropriate to the student's educational objectives should be selected in consultation with the student's advisor. Independent study courses (i.e., CSE 492) do not count towards the breadth requirement. Special topic or experimental courses (i.e., CSE 450, CSE 498) may count toward the breadth requirement if approved in advance. Similarly, courses from outside the CSE department may count toward the breadth requirement if approved in advance.

The Masters degrees have a skills requirement. Students must complete three (3) credits of coursework at the 400-level in at least four (4) of the following skill areas: Theory; Applied Theory; Advanced Applications; Knowledge-Based Systems; Computer Hardware, Systems, and Networking; Security in Computational Environment; and Software and Programming. The skill requirement ensures that all students pursuing a Masters degree possess the breadth needed to excel in careers in the computing and software industries.

Additional courses appropriate to the student's education objectives should be selected in consultation with the student's advisor. Independent study courses (i.e., CSE 492) do not count towards the skill requirement. Special topic or experimental courses (i.e., CSE 450, CSE 498) may count toward the breadth requirement if approved in advance.

For both the PhD and Masters degrees, courses from other universities or undergraduate studies may be used to satisfy these requirements, by petition, at the discretion of the program director. Additional graduate program information may be obtained from the department's graduate coordinator.

Courses

CSE 003 Introduction to Programming, Part A 2 Credits
Covers the same material as the first half of CSE 007. No prior programming experience needed. Cannot be taken by students who have completed CSE 007.
Attribute/Distribution: Q

CSE 004 Introduction to Programming, Part B 2 Credits
Covers the same material as the second half of CSE 007. Cannot be taken by students who have completed CSE 007.
Prerequisites: CSE 003

CSE 007 Introduction to Programming 0,4 Credits
Problem-solving using the Java programming language. Data types, control flow, methods, arrays, objects, inheritance, breadth of computing. Includes recitation. If credit is given for CSE 007 then no credit will be given for CSE 003 nor CSE 004.
Attribute/Distribution: Q

CSE 012 Introduction to Programming with Python 3 Credits
Fundamental concepts of computing and "computational thinking": problem analysis, abstraction, algorithms, digital representation of information, and networks. Concepts of software development using the Python language. This course will not be considered as a CSE technical elective for CS majors.
Attribute/Distribution: Q

CSE 017 Programming and Data Structures 0,3 Credits
Design and implementation of algorithms and data structures using Java. Assumes that students have prior experience using conditional statements, loops, arrays, and object-oriented programming in Java. Algorithmic techniques such as recursion, algorithm analysis, and sorting. Design and implementation of data structures such as lists, queues, stacks, trees, and hash tables.
Prerequisites: CSE 004 or CSE 007
Attribute/Distribution: Q

CSE 042 (EMC 042) Game Design 3 Credits
Modern topics in game design: Finite State Machines, iterative design process, systems and interactivity, designing rules for digital games, emergence in games, games as Schemas of Uncertainty, games as Information Theory Schemas, games as Information Systems, games as Cybernetic Systems. The course does not count as a technical elective for majors in Computer Science, Computer Science and Business, or Computer Engineering.

CSE 100 Teaching Assistant Workshop 0-1 Credits
This course is required of all teaching assistants and graders. The course covers the roles and responsibilities of teaching assistants and graders and how to create a positive learning environment, effectively communicate, manage the classroom, grade and assess, employ various teaching techniques, and leverage technology in the classroom. The challenges faced by students and their perspective while learning and applying new concepts are discussed throughout. Department approval is required.

CSE 109 Systems Software 0,4 Credits
Advanced programming and data structures, including dynamic structures, memory allocation, data organization, symbol tables, hash tables, B-trees, data files. Object-oriented design and implementation of simple assemblers, loaders, interpreters, compilers, and translators. Practical methods for implementing medium-scale programs.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 127 (COGS 127) Survey of Artificial Intelligence 3 Credits
An introduction to artificial intelligence (AI) intended for non-majors. AI concepts, systems, and history. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.
Prerequisites: CSE 004 or CSE 007 or CSE 012
Attribute/Distribution: Q

CSE 140 Foundations of Discrete Structures and Algorithms 0,3 Credits
Basic representations used in algorithms: propositional and predicate logic, set operations and functions, relations and their representations, matrices and their representations, graphs and their representations, trees and their representations. Basic formalizations for proving algorithm correctness: logical consequences, induction, structural induction. Basic formalizations for algorithm analysis: counting, pigeonhole principle, permutations.
Prerequisites: (MATH 021 or MATH 031 or MATH 051 or MATH 076) and CSE 017
Can be taken Concurrently: CSE 017
Attribute/Distribution: Q

CSE 160 Introduction to Data Science 0,3 Credits
Data Science is a fast-growing interdisciplinary field, focusing on the computational analysis of data to extract knowledge and insight. Collection, preparation, analysis, modeling, and visualization of data, covering both conceptual and practical issues. Examples from diverse fields and hands-on use of statistical and data manipulation software.
Prerequisites: CSE 004 or CSE 007 or CSE 012 or BIS 335
Attribute/Distribution: Q

CSE 190 Special Topics 1-3 Credits
Supervised reading and research. Consent of department required.

CSE 202 Computer Organization and Architecture 3 Credits
Interaction between low-level computer architectural properties and high-level program behaviors: instruction set design; digital logic and assembly language; processor organization; the memory hierarchy; multicore and GPU architectures; and processor interrupt/exception models. Credit will not be given for both CSE 201 and CSE 202.
Prerequisites: CSE 017 or CSE 018

CSE 216 Software Engineering 0,3 Credits
The software lifecycle; lifecycle models; software planning; testing; specification methods; maintenance. Emphasis on team work and large-scale software systems, including oral presentations and written reports.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 217 Computer Science Projects 3 Credits
Project-based learning through independent or small-group projects related to computer systems and/or applications. Students will progress through the software development lifecycle, including high-level design, functional and non-functional requirements, implementation, testing, and maintenance. One large group meeting per week, where students serve as consultants to each other as they present their progress.
Prerequisites: CSE 216
Attribute/Distribution: W

CSE 241 Database Systems and Applications 0,3 Credits
Design of large databases: Integration of databases and applications using SQL and JDBC; transaction processing; performance tuning; data mining and data warehouses. Not available to students who have credit for CSE 341 or ISE 224.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 242 Blockchain Algorithms and Systems 3 Credits
Blockchain system concepts, data structures, and algorithms. Cryptographic algorithms for blockchain security. Distributed consensus algorithms for decentralized control in both a public and permissioned blockchain setting. Smart contracts. Cross-chain transactions. Blockchain databases and enterprise blockchains.
Prerequisites: CSE 109 or CSE 241 or CSE 341
Can be taken Concurrently: CSE 109
Attribute/Distribution: Q

CSE 252 (EMC 252) Computers, the Internet, and Society 3 Credits
An interactive exploration of the current and future role of computers, the Internet, and related technologies in changing the standard of living, work environments, society and its ethical values. Privacy, security, depersonalization, responsibility, and professional ethics; the role of computer and Internet technologies in changing education, business modalities, collaboration mechanisms, and everyday life.
Attribute/Distribution: SW, W

CSE 260 Foundations of Robotics 3 Credits
This course introduces students to the field of robotics, covering foundational mathematics and physics as well as important algorithms and tools. Topics include simulation, kinematics, control, machine learning, and probabilistic inference. The mathematical basis of each area will be covered, followed by practical application to common robotics tasks. This course is designed to be taught remotely using simulated robot platforms and sensors.
Prerequisites: CSE 140
Attribute/Distribution: Q

CSE 261 (MATH 261) Discrete Structures 3 Credits
Topics in discrete structures chosen for their applicability to computer science and engineering. Sets, propositions, induction, recursion; combinatorics; binary relations and functions; ordering, lattices and Boolean algebra; graphs and trees; groups and homomorphisms. Various applications.
Prerequisites: (MATH 021 or MATH 031 or MATH 051 or MATH 076)
Attribute/Distribution: MA

CSE 262 Programming Languages 0,3 Credits
Use, structure and implementation of several programming languages.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 264 Web Systems Programming 3 Credits
Practical experience in designing and implementing modern Web applications. Concepts, tools, and techniques, including: HTTP, HTML, CSS, DOM, JavaScript, Ajax, PHP, graphic design principles, mobile web development. Not available to students who have credit for IE 275.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 265 System and Network Administration 0,3 Credits
Overview of systems and network administration in a networked UNIX-like environment. System installation, configuration, administration, and maintenance; security principles; ethics; network, host, and user management; standard services such as electronic mail, DNS, and WWW; file systems; backups and disaster recovery planning; troubleshooting and support services; automation, scripting; infrastructure planning.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 271 Programming in Linux and Windows Operating Systems 3 Credits
Students learn Linux and Windows operating system fundamentals, including features, history, organization, process management, and file systems. Tools commonly available with these operating systems, such as those for program development, text processing, scheduling jobs, and communications, are also explored. Emphasis is placed on learning the BASh and PowerShell scripting languages, and students should expect to work on a variety of small programming assignments.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 280 Capstone Project I 3 Credits
First of a two semester capstone course sequence that involves the design, implementation, and evaluation of a computer science software project. Conducted by small student teams working from project definition to final documentation. Each student team has a CSE faculty member serving as its advisor. The first semester emphasis is on project definition, planning and implementation. Communication skills such as technical writing, oral presentations, and use of visual aids are also emphasized. Project work is supplemented by weekly seminars.
Prerequisites: CSE 216
Can be taken Concurrently: CSE 216
Attribute/Distribution: W

CSE 281 Capstone Project II 0,3 Credits
Second of a two semester capstone course sequence that involves the design, implementation, and evaluation of a computer science software project; conducted by small student teams working from project definition to final documentation; each student team has a CSE faculty member serving as its advisor; The second semester emphasis is on project implementation, verification & validation, and documentation requirements. It culminates in a public presentation and live demonstration to external judges as well as CSE faculty and students.
Prerequisites: CSE 280
Attribute/Distribution: W

CSE 300 Apprentice Teaching 1-4 Credits
Practical teaching experience under supervision of an experienced instructor. Students learn fundamentals of teaching, including course and lecture planning, instructional delivery, classroom environment and management, and assessment. Students will benefit from significant hands-on experience in the lectures, recitations, and office hours. Department approval is required.
Repeat Status: Course may be repeated.

CSE 302 Compiler Design 3 Credits
Principles of artificial language description and design. Sentence parsing techniques, including operator precedence, bounded-context, and syntax-directed recognizer schemes. The semantic problem as it relates to interpreters and compilers. Dynamic storage allocation, table grammars, code optimization, compiler-writing languages.
Prerequisites: (CSE 109)
Attribute/Distribution: Q

CSE 303 Operating System Design 3 Credits
Process and thread programming models, management, and scheduling. Resource sharing and deadlocks. Memory management, including virtual memory and page replacement strategies. I/O issues in the operating system. File system implementation. Multiprocessing. Computer security as it impacts the operating system.
Prerequisites: ECE 201 or (CSE 201 or CSE 202) and CSE 109
Attribute/Distribution: Q

CSE 307 (BIOE 307) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and -DNA interactions; molecular simulation, electrostatics. Tutorials on UNIX systems and research software support an interdisciplinary collaborative project in computational structural biology. Credit will not be given for both CSE 307 and CSE 407. Must have junior standing or higher.
Prerequisites: BIOS 120 or CSE 109 or CHM 113 or MATH 231
Attribute/Distribution: Q

CSE 308 (BIOE 308) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. Credit will not be given for both CSE 308 (BIOE 308) and CSE 408 (BIOE 408). No prior background in biology is assumed.
Prerequisites: CSE 017

CSE 310 (BSTA 310) Assistive Technologies 3 Credits
This class will introduce typical challenges faced by persons with disabilities and the role of assistive technologies (ATs) in solving such challenges. The class will examine opportunities presented by recent advances in mobile and AI technologies. Working in groups, each student will be expected to acquire and apply relevant skills in designing AT solutions. The class can be taken by students with diverse backgrounds including the following: community and population health, social and behavioral sciences, business, engineering and computer science.
Prerequisites: CSE 017 or (BSTA 101 and BSTA 102)

CSE 313 Computer Graphics 3 Credits
Computer graphics for animation, visualization, and production of special effects: displays, methods of interaction, images, image processing, color, transformations, modeling (primitives, hierarchies, polygon meshes, curves and surfaces, procedural), animation (keyframing, dynamic simulation), rendering and realism (shading, texturing, shadows, visibility, ray tracing), and programmable graphics hardware.
Prerequisites: CSE 109 and (MATH 043 or MATH 205 or MATH 242)
Attribute/Distribution: Q

CSE 318 Introduction to the Theory of Computation 3 Credits
Provides a deep understanding of computation, its capabilities and its limitations. The course uses discrete formal methods to (1) formulate precise definitions of three kinds of finite-state machines (finite automata, pushdown automata, and Turing machines); (2) prove properties of these machines by studying their expressiveness (i.e., the kinds of problems that can be solved with these machines), and (3) study computational problems that cannot be solved with algorithms.
Prerequisites: CSE 140
Attribute/Distribution: Q

CSE 319 Image Analysis and Graphics 3 Credits
State-of-the-art techniques for fundamental image analysis tasks: feature extraction, segmentation, registration, tracking, recognition, search (indexing and retrieval). Related computer graphics techniques: modeling (geometry, physically-based, statistical), simulation (data-driven, interactive), animation, 3D image visualization, and rendering. Credit will not be given for both CSE 319 and CSE 419.
Prerequisites: CSE 313
Attribute/Distribution: Q

CSE 320 (BIOE 320) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. Credit will not be given for both CSE 320 and CSE 420.
Prerequisites: (MATH 205 or MATH 043) and CSE 017
Attribute/Distribution: Q

CSE 323 Computer Vision 3 Credits
Fundamental techniques from image processing, pattern recognition, machine learning and deep learning used to process and understand visual data. Build full pipelines for solutions to classic vision problems such as object detection and recognition, image matching and retrieval, and scene understanding and reconstruction. New and challenging problems such as synthetic image generation. Credit will not be given for both CSE 323 and CSE 423.
Prerequisites: ((MATH 205 or MATH 242) and (MATH 231 or ECO 045) and CSE 017) or (DSCI 311 and DSCI 321)

CSE 325 Natural Language Processing 3 Credits
Overview of modern natural language processing techniques: text normalization, language model, part-of-speech tagging, hidden Markov model, syntactic and dependency parsing, semantics, word sense, reference resolution, dialog agent, machine translation. Design, implementation and evaluation of classic NLP algorithms. Credit will not be given for both CSE 325 and CSE 425.
Prerequisites: (MATH 231 or ECO 045 or ISE 121) and CSE 017 and (MATH 205 or MATH 241 or MATH 242) and (CSE 160 or CSE 326 or CSE 327 or MATH 365 or ECE 414 or ISE 364 or ISE 365 or ISE 367)
Attribute/Distribution: Q

CSE 326 Fundamentals of Machine Learning 3 Credits
Bayesian decision theory and the design of parametric and nonparametric classification and regression: linear, quadratic, nearest-neighbors, neural nets. Boosting, bagging. Credit will not be given for both CSE 326 and CSE 426.
Prerequisites: CSE 017 and (MATH 205 or MATH 043) and (MATH 231 or ISE 121 or ECO 045)

CSE 327 (COGS 327) Artificial Intelligence Theory and Practice 3 Credits
Detailed analysis of a broad range of artificial intelligence (AI) algorithms and systems. Problem solving, knowledge representation, reasoning, planning, uncertainty and machine learning. Applications of AI to areas such as natural language processing, vision, and robotics. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.
Prerequisites: CSE 017 and CSE 140
Attribute/Distribution: Q

CSE 331 User Interface Systems and Techniques 3 Credits
Principles and practice of creating effective human-computer interfaces. Design and user evaluation of user interfaces; design and use of interface building tools. Programming projects using a variety of interface building tools to construct and evaluate interfaces.
Prerequisites: CSE 017
Attribute/Distribution: Q

CSE 333 Methods for Understanding Human-Computer Interactions 3 Credits
Covers a variety of methods for conducting research on human interactions with computing systems. Methods covered may include: controlled experiments, surveys, ethnography, grounded theory, research through design, log data analysis, retrospective techniques, social network analysis, and others. Taking this course will familiarize the student with several of these methods through readings and in-class discussion and activities, as well as provide the student the opportunity to gain significant experience applying one of these methods in a project.
Prerequisites: CSE 252 or CSE 331

CSE 335 Topics on Intelligent Decision Support Systems 3 Credits
Intelligent decision support systems (IDSSs). AI techniques that are used to build IDSSs: case-based reasoning, decision trees and knowledge representation. Applications of these techniques: help-desk systems, e-commerce, and knowledge management. Credit will not be given for both CSE 335 and CSE 435.
Prerequisites: CSE 327 or CSE 109
Attribute/Distribution: Q

CSE 336 (ECE 336) Embedded Systems 3 Credits
Use of small computers embedded as part of other machines. Limited-resource microcontrollers and state machines from high description language. Embedded hardware: RAM, ROM, flash, timers, UARTs, PWM, A/D, multiplexing, debouncing. Development and debugging tools running on host computers. Real-Time Operating System (RTOS) semaphores, mailboxes, queues. Task priorities and rate monotonic scheduling. Software architectures for embedded systems.
Prerequisites: CSE 017

CSE 337 Reinforcement Learning 3 Credits
Algorithms for automated learning from interactions with the environment to optimize long-term performance. Markov decision processes, dynamic programming, temporal-difference learning, Monte Carlo reinforcement learning methods. Credit will not be given for both CSE 337 and CSE 437.
Prerequisites: (MATH 231, ECO 045) and CSE 109
Attribute/Distribution: Q

CSE 340 (MATH 340) Design and Analysis of Algorithms 0,3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, finding shortest paths and minimum spanning trees, scheduling tasks, etc.: proofs of their correctness and analysis of their asymptotic runtime and memory demands. Designing algorithms: recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency using elementary NP-completeness theory.
Prerequisites: (MATH 021 or MATH 031 or MATH 076) and CSE 140 and CSE 017
Attribute/Distribution: Q

CSE 341 Database Systems, Algorithms, and Applications 3 Credits
Design of large databases; normalization; query languages (including SQL); Transaction-processing protocols; Query optimization; performance tuning; distributed systems. Not available to students who have credit for CSE 241.
Prerequisites: CSE 017 and CSE 140
Attribute/Distribution: Q

CSE 342 Fundamentals of Internetworking 3 Credits
Architecture and protocols of computer networks. Protocol layers; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local and wide area networks; network interconnection; client-server interaction; emerging networking trends and technologies; topics in security and privacy.
Prerequisites: CSE 109
Attribute/Distribution: Q

CSE 343 Network Security 3 Credits
Overview of network security threats and vulnerabilities. Techniques and tools for detecting, responding to and recovering from security incidents. Fundamentals of cryptography. Hands-on experience with programming techniques for security protocols. Credit will not be given for both CSE 343 and CSE 443.
Prerequisites: CSE 202 or CSE 271 or CSE 342
Attribute/Distribution: Q

CSE 345 WWW Search Engines 3 Credits
Study of algorithms, architectures, and implementations of WWW search engines; Information retrieval (IR) models; performance evaluation; properties of hypertext crawling, indexing, searching and ranking; link analysis; parallel and distributed IR; user interfaces. Credit will not be given for both CSE 345 and CSE 445.
Prerequisites: CSE 109
Attribute/Distribution: Q

CSE 347 Data Mining 3 Credits
Overview of modern data mining techniques: data cleaning; attribute and subset selection; model construction, evaluation and application. Fundamental mathematics and algorithms for decision trees, covering algorithms, association mining, statistical modeling, linear models, neural networks, instance-based learning and clustering covered. Practical design, implementation, application, and evaluation of data mining techniques in class projects. Credit will not be given for both CSE 347 and CSE 447.
Prerequisites: CSE 017 and (CSE 160 or CSE 326) and (MATH 231 or MATH 205 or MATH 241 or MATH 242 or ECO 045 or ISE 121)
Attribute/Distribution: Q

CSE 348 AI Game Programming 3 Credits
Contemporary computer games: techniques for implementing the program controlling the computer component; using Artificial Intelligence in contemporary computer games to enhance the gaming experience: pathfinding and navigation systems; group movement and tactics; adaptive games, game genres, machine scripting language for game designers, and player modeling. Credit will not be given for both CSE 348 and CSE 448.
Prerequisites: CSE 327 or CSE 109
Attribute/Distribution: Q

CSE 349 Big Data Analytics 3 Credits
Provides working knowledge of large-scale data analysis using open source frameworks such as Apache Spark and Waikato Environment for Knowledge Analysis (Weka). Includes patterns employed in big data analytics, including classification, collaborative filtering, recommender systems, natural language processing, simulation, deep learning, and anomaly detection. Project-oriented software course; students should have substantial programming experience in one or more high-level languages. Past experience in data mining and/or machine learning expected. Credit will not be given for both 349 and 449.
Prerequisites: CSE 109 and (CSE 326 or CSE 347)

CSE 350 Special Topics 3 Credits
Selected topics in the field of computer science not included in other courses.
Repeat Status: Course may be repeated.
Prerequisites: MATH 205

CSE 351 Iterative Methods 3 Credits
Commonly used iterative methods for efficiently solving large, sparse linear systems. Review of basic numeric analysis, direct methods, iterative methods, Krylov subspace methods, preconditioning techniques, and multigrid methods. Analysis of theoretical properties, including convergence behavior and computational and memory demands. Evaluation of performance using numerical experimentation on various real-world applications using Matlab. Credit will not be given for both CSE 351 and CSE 451.
Prerequisites: CSE 109 and CSE 140 and (MATH 205 or MATH 043)

CSE 360 Introduction to Mobile Robotics 3 Credits
Algorithms employed in mobile robotics for navigation, sensing, and estimation. Common sensor systems, motion planning, robust estimation, bayesian estimation techniques, Kalman and Particle filters, localization and mapping. Credit will not be given for both CSE 360 and CSE 460.
Prerequisites: MATH 205
Attribute/Distribution: Q

CSE 367 Blockchain Projects 0,3 Credits
Independent or small-group unique projects related to blockchain systems and/or applications. While pursuing their own project, students serve as consultants to the other teams via a once-weekly class meeting in which each team presents updates on status, progress, and open problems, and one student gives a longer prepared presentation on current research or development results in the blockchain field. Each project team has its own separate second weekly meeting with the instructor for a more in-depth project review and discussion.
Repeat Status: Course may be repeated.
Prerequisites: CSE 242
Attribute/Distribution: Q

CSE 371 Principles of Mobile Computing 3 Credits
Fundamental concepts and technology underlying mobile computing. Current research in these areas. Examples drawn from a variety of application domains such as health monitoring, energy management, commerce, and travel. Issues of system efficiency will be studied, including efficient handling of large data such as images and effective use of cloud storage. Recent research papers will be discussed. Credit will not be given for both CSE371 and CSE471.
Prerequisites: (CSE 109 and (CSE 202 or ECE 201),)
Attribute/Distribution: Q

CSE 375 Principles of Practice of Parallel Computing 3 Credits
Parallel computer architectures, parallel languages, parallelizing compilers and operating systems. Design, implementation, and analysis of parallel algorithms for scientific and data-intensive computing. Credit is not given for both CSE 375 and CSE 475.
Prerequisites: (ECE 201 or CSE 201) or CSE 303 or CSE 202
Can be taken Concurrently: ECE 201, CSE 201, CSE 303, CSE 202
Attribute/Distribution: Q

CSE 376 Distributed Systems 3 Credits
Exploration of theoretical and practical aspects of topics in distributed systems through a combination of readings, programming assignments, and projects. The main focal point is large distributed systems, in particular protocols to synchronize the activities of machines when operating over shared data. Techniques to ensure fault-tolerance and service-availability will also be discussed. Using distributed systems as a foundation, students gain skills in the design of complex, multilayered systems. Credit will not be given for both CSE 376 and CSE 476.
Prerequisites: CSE 303 and CSE 340 and (CSE 241 or CSE 242 or CSE 341 or CSE 375)
Attribute/Distribution: Q

CSE 389 Honors Project 1-8 Credits

CSE 392 Independent Study 1-3 Credits
An intensive study, with report, of a topic in computer science which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 401 (ECE 401) Advanced Computer Architecture 3 Credits
Design, analysis and performance of computer architectures; high-speed memory systems; cache design and analysis; modeling cache performance; principle of pipeline processing, performance of pipelined computers; scheduling and control of a pipeline; classification of parallel architectures; systolic and data flow architectures; multiprocessor performance; multiprocessor interconnections and cache coherence.

CSE 403 Advanced Operating Systems 3 Credits
Principles of operating systems with emphasis on hardware and software requirements and design methodologies for multi-programming systems. Global topics include the related areas of process management, resource management, and file systems.
Prerequisites: CSE 303

CSE 404 (ECE 404) Computer Networks 3 Credits
Study of architecture and protocols of computer networks. The ISO model; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local area networks; network interconnection; topics in security and privacy.

CSE 405 Advanced Programming Languages 3 Credits
Basic ideas behind modern programming language design, with a focus on functional languages: type systems, modularity, operational semantics, and others. Students need to have some mathematical maturity, including familiarity with proof techniques such as induction.

CSE 406 Research Methods 3 Credits
Technical writing, reading the literature critically, analyzing and presenting data, conducting research, making effective presentations, and understanding social and ethical responsibilities. Topics drawn from probability and statistics, use of scripting languages, and conducting large-scale experiments. Must have first-year status in either the CS or CompE Ph. D. program.

CSE 407 (BIOE 407) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and –DNA interactions; molecular simulation, electrostatics. This course, a version of 307 for graduate students, requires advanced assignments and a collaborative project. Credit will not be given for both CSE 307 and 407. Consent of instructor required.

CSE 408 (BIOE 408) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. This course, a version of 308 for graduate students requires advanced assignments. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018

CSE 409 Theory of Computation 3 Credits
Finite automata. Pushdown automata. Relationship to definition and parsing of formal grammars. Credits will not be given for both CSE318 and CSE409.
Prerequisites: CSE 318 or CSC 318

CSE 410 (BSTA 410) Assistive Technologies 3 Credits
This class will introduce typical challenges faced by persons with disabilities and the role of assistive technologies (ATs) in solving such challenges. The class will examine opportunities presented by recent advances in mobile and AI technologies. Working in groups, each student will be expected to acquire and apply relevant skills in designing AT solutions. The class can be taken by students with diverse backgrounds including the following: community and population health, social and behavioral sciences, business, engineering and computer science.

CSE 411 Advanced Programming Techniques 3 Credits
Deeper study of programming and software engineering techniques. The majority of assignments involve programming in contemporary programming languages. Topics include memory management, GUI design, testing, refactoring, and writing secure code.

CSE 413 Computer Graphics 3 Credits
Computer graphics for animation, visualization, and production of special effects: displays, methods of interaction, images, image processing, color, transformations, modeling (primitives, hierarchies, polygon meshes, curves and surfaces, procedural), animation (keyframing, dynamic simulation), rendering and realism (shading, texturing, shadows, visibility, ray tracing), and programmable graphics hardware. Department approval required. Credit will not be given for both CSE 313 and CSE 413.

CSE 418 Theory of Computation 3 Credits
Finite automata. Pushdown automata. Relationship to definition and parsing of formal grammars. Credit may be given for only one of the following: CSE318 and CSE409 and CSE418.

CSE 419 Image Analysis and Graphics 3 Credits
State-of-the-art techniques for fundamental image analysis tasks; feature extraction, segmentation, registration, tracking, recognition, search (indexing and retrieval). Related computer graphics techniques: modeling (geometry, physically-based, statistical), simulation (data-driven, interactive), animation, 3D image visualization, and rendering. This course, a graduate version of CSE 319, requires additional advanced assignments. Credit will not be given for both CSE 319 and CSE 419.

CSE 420 (BIOE 420) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. This course, a graduate version of BIOE 320, requires additional advanced assignments. Credit will not be given for both BIOE 320 and BIOE 420.
Prerequisites: MATH 205 and CSE 109
Attribute/Distribution: ND

CSE 424 Advanced Communication Networks 3 Credits
Current and emerging research topics in communication networks: network protocols, network measurement, internet routing, network security, adhoc and sensor networks, disruption tolerant networks. Lecture, readings, and discussion, plus a project.
Prerequisites: CSE 342 or CSE 303 or CSE 404

CSE 425 Natural Language Processing 3 Credits
Overview of modern natural language processing techniques: text normal- ization, language model, part-of-speech tagging, hidden Markov model, syntatic and dependency parsing, semantics, word sense, reference resolution, dialog agent, machine translation. Three projects to design, implement and evaluate classic NLP algorithms. Credit will not be given for both CSE 325 and CSE 425.
Prerequisites: (MATH 231 or ECO 045) and CSE 017

CSE 426 Fundamentals of Machine Learning 3 Credits
Bayesian decision theory and the design of parametric and nonparametric classification and regression: linear, quadratic, nearest-neighbors, neural nets. Boosting, bagging. This course, a version of CSE 326 for graduate students requires advanced assignments. Credit will not be given for both CSE 326 and CSE 426.

CSE 428 Semantic Web Topics 3 Credits
Theory, architecture and applications of the Semantic Web. Issues in designing distributed knowledge representation languages, ontology development, knowledge acquisition, scalable reasoning, integrating heterogeneous data sources, and web-based agents.

CSE 431 Intelligent Agents 3 Credits
Principles of rational autonomous software systems. Agent theory; agent architectures, including logic-based, utility-based, practical reasoning, and reactive; multi-agent systems; communication languages; coordination methods including negotiation and distributed problem solving; applications.

CSE 433 Advanced Methods for Understanding Human-Computer Interactions 3 Credits
Covers a variety of methods for conducting research on human interactions with computing systems. Methods covered may include: controlled experiments, surveys, ethnography, grounded theory, research through design, log data analysis, retrospective techniques, social network analysis, and others. Taking this course will familiarize the student with several of these methods through readings and in-class discussion and activities, as well as provide the student the opportunity to gain significant experience applying one of these methods in a project.
Prerequisites: CSE 333

CSE 435 Topics on Intelligent Decision Support Systems 3 Credits
AI techniques used to build IDSSs: case-based reasoning, decision trees and knowledge representation. Applications: helpdesk systems, e-commerce, and knowledge management. This course, a version of CSE 335 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 335 and CSE 435.

CSE 437 Reinforcement Learning and Markov Decision Precesses 3 Credits
Formal model based on Markov decision processes for automated learning from interactions with stochastic, incompletely known environments. Markov decision processes, dynamic programming, temporal-difference learning, Monte Carlo reinforcement learning methods. Credit will not be given for both CSE 337 and CSE 437. Must have graduate standing in Computer Science or have consent of instructor.

CSE 440 Advanced Algorithms 3 Credits
Average-case runtime analysis of algorithms. Randomized algorithms and probabilistic analysis of their performance. Analysis of data structures including hash tables, augmented data structures with order statistics. Amortized analysis. Elementary computational geometry. Limits on algorithm space efficiency using PSPACE-completeness theory. Credit will not be given for both CSE 440 and CSE 441.
Prerequisites: CSE 340 or MATH 340

CSE 442 Advanced Blockchain Systems and Theory 3 Credits
Formal foundations of blockchain systems: cryptography, consensus, zero-knowledge proofs, transaction processing both on-chain and cross-chain, validation, and governance. Algorithms and data structures for blockchain systems. Programming paradigms for smart contracts. Current research in blockchain drawing from the cryptography, database, operating system, and parallel computing research communities.
Prerequisites: CSE 241 or CSE 341 or CSE 303 or CSE 403 or CSE 375 or CSE 475

CSE 443 Network Security 3 Credits
Overview of network security threats and vulnerabilities. Techniques and tools for detecting, responding to and recovering from security incidents. Fundamentals of cryptography. Hands-on experience with programming techniques for security protocols. This course, a version of CSE 343 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 343 and CSE 443.
Prerequisites: (CSE 404 or ECE 404) or CSE 271 or CSE 202 or CSE 342

CSE 445 WWW Search Engines 3 Credits
Study of algorithms, architectures, and implementations of WWW search engines. Information retrieval (IR) models; performance evaluation; properties of hypertext crawling, indexing, searching and ranking; link analysis; parallel and distributed IR; user interfaces. This course, a version of CSE 345 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 345 and CSE 445.

CSE 447 Data Mining 3 Credits
Modern data mining techniques: data cleaning; attribute and subset selection; model construction, evaluation and application. Algorithms for decision trees, covering algorithms, association rule mining, statistical modeling, model and regression trees, neural networks, instance-based learning and clustering covered. This course, a version of CSE 347 for graduate students, requires research projects and advanced assignments, and expects students to have a background in probability, statistics, and programming. Credit will not be given for both CSE 347 and CSE 447.
Prerequisites: CSE 326

CSE 449 Big Data Analytics 3 Credits
Provides working knowledge of large-scale data analysis using open source frameworks such as Apache Spark and Waikato Environment for Knowledge Analysis (Weka). Includes patterns employed in big data analytics, including classification, collaborative filtering, recommender systems, natural language processing, simulation, deep learning, and anomaly detection. Project-oriented software course; students should have substantial programming experience in one or more high-level languages. Past experience in data mining and/or machine learning expected. Credit will not be given for both 349 and 449.
Prerequisites: CSE 109 and (CSE 326 or CSE 347)

CSE 450 Special Topics 3 Credits
Selected topics in computer science not included in other courses.
Repeat Status: Course may be repeated.

CSE 460 Mobile Robotics 3 Credits
Algorithms employed in mobile robotics for navigation, sensing, and estimation. Common sensor systems, motion planning, robust estimation, Bayesian estimation techniques, Kalman and particle filters, localization and mapping. This course, a version of CSE 360 for graduate students will require an independent project to be presented in class. Credit will not be given for both CSE 360 and CSE 460.

CSE 467 Blockchain Projects 0,3 Credits
Independent or small-group graduate-level unique projects related to blockchain-systems and/or applications. While pursuing their own project, students serve as consultants to the other teams via a once-weekly class meeting in which each team presents updates on status, progress, and open problems, and one student gives a longer prepared presentation on current research or development results in the blockchain field. Each project team has its own separate second weekly meeting with the instructor for a more in-depth project review and discussion.
Repeat Status: Course may be repeated.

CSE 471 Principles of Mobile Computing 3 Credits
Course topics include fundamental concepts and technology underlying mobile computing and current research in these areas. Examples drawn from a variety of application domains such as health monitoring, energy management, commerce, and travel. Issues of system efficiency will be studied, including efficient handling of large data such as images and effective use of cloud storage. Recent research papers will be discussed. The graduate version of CSE 371 requires additional effort. Credit will not be given for both CSE371 and CSE471.
Prerequisites: CSE 109 and CSE 202 or CSE 303

CSE 475 Principles and Practice of Parallel Computing 3 Credits
Parallel computer architectures, parallel languages, parallelizing compilers and operating systems. Design, implementation, and analysis of parallel algorithms for scientific and data-intensive computing. This is a graduate version of CSE 375. As such, it will require additional assignments. Credit is not given for both CSE 375 and CSE 475.

CSE 476 Distributed Systems 3 Credits
Exploration of theoretical and practical aspects of topics in distributed systems through a combination of readings, programming assignments, and projects. The main focal point is large distributed systems, in particular protocols to synchronize the activities of machines when operating over shared data. Techniques to ensure fault-tolerance and service-availability will also be discussed. Using distributed systems as a foundation, students gain skills in the design of complex, multilayered systems. Credit will not be given for both CSE 376 and CSE 476.
Prerequisites: (CSE 303 or CSE 403) and (CSE 340 or CSE 440) and (CSE 241 or CSE 242 or CSE 341 or CSE 375 or CSE 404 or ECE 404 or CSE 475)

CSE 490 Thesis 1-6 Credits
Thesis.
Repeat Status: Course may be repeated.

CSE 491 Research Seminar 1-3 Credits
Regular meetings focused on specific topics related to the research interests of department faculty. Current research will be discussed. Students may be required to present and review relevant publications. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 492 Independent Study 1-3 Credits
An intensive study, with report of a topic in computer science that is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 499 Dissertation 1-15 Credits

Cooperative Graduate Education

The P.C. Rossin College of Engineering and Applied Science permits graduate students to spend part of their academic experience in industry, business, or a government agency. In general, the external experience should be complementary to their graduate studies at Lehigh University and can count towards their degree program through ENGR 400 Engineering Experiential Learning for Engineering Graduate Students (see Graduate tab). Permission of the department chair is required in order to participate in this program.

Subject to university/federal regulations, when enrolled in courses at Lehigh University, a student can work for a maximum of 20 hours at the company/laboratory (external partner). If not enrolled in courses other than ENGR 400, a student may be permitted to work full time during the external experience. Full time employment over the summer may also be permitted. Maintenance of full-time status, however, requires that during the semester students must be registered for the minimum number of credit hours as listed in R&P or meet the qualifications to be certified as a full-time student.

MS/MENG CO-OP PROGRAMS

• ENGR 400 can be taken for a maximum of 6 credits, with at most 3 credits in any registration period.

• Minimum of 18 course credit hours, excluding ENGR 400 and Thesis (ENGR 490) must be obtained through Lehigh University

PH.D. PROGRAM

• 9 credits of ENGR 400 can be taken throughout a student's entire graduate study at Lehigh, with at most 3 credits in any registration period.

Courses

ENGR 400 Experiential Learning for Engineering Graduate Students 1-3 Credits
Supervised work assignment outside of the university to obtain practical experience in field of study. Requires consent of department chairperson. When on an assignment, the student must register for this course to maintain continuous student status. Limit to at most three credits per registration period. No more than six credits may be applied towards a master's program and no more than nine credits may be used throughout a student's entire graduate study at Lehigh.
Repeat Status: Course may be repeated.

ENGR 401 Teaching/Presentation Skills 1 Credit
Development of teaching and presentation skills for scientific professionals. Presentation effectiveness, teaching/presentation methodologies, classroom management, course development/ content preparation, lecture/presentation development and lecture/ presentation delivery. Individualized undergraduate course specific modules selected by student. Enrollment limited to Rossin Doctoral Fellows.

ENGR 402 Preparing for the Professoriate 1 Credit
Overview of the job search, research program development and service skills for graduate students entering academic careers. Transition from graduate student to faculty responsibilities, the post-doctoral experience, time management, CV/resume preparation, faculty search process, tenure and promotion, research leadership and program development, research proposal preparation and research sponsorship. Enrollment limited to Rossin Doctoral Fellows.

ENGR 430 Technical Writing for Engineering and the Sciences 1 Credit
Formal composition and technical writing skills for advanced non-native English writers in Engineering and the Sciences. Instructor and peer review of writing, self-editing strategies, how to incorporate technical vocabulary and formulas, advanced sentence structure, and appropriate citation of research. Field-specific readings, which students must compile, critique, and model in their own writing. Designed for international graduate students who are writing or preparing to write publishable quality articles, theses, or dissertations.

ENGR 440 Intensive Teaching Workshop 0 Credits
Two-day intensive teaching workshop designed to prepare doctoral students for a teaching practicum experience. Various faculty will discuss a range of topics including fundamentals of effective teaching, motivating students, inclusive teaching, principles of teaching under a research perspective, explaining difficult topics, assessing student learning and enhancing learning with instructional technology. Students will be required to prepare and lead micro-teaching sessions. Course requires Dean's office permission and may not be repeated.

ENGR 441 Teaching Practicum 1-3 Credits
Mentored teaching experience focused on the design, organization, pedagogy and assessment of university courses in engineering. Students will work with a faculty member to develop teaching and communication skills and apply best practices in university teaching while receiving feedback. Specific course assignments will be determined by the student's home department and must be approved by the department chair. Course may be repeated for credit.
Repeat Status: Course may be repeated.
Prerequisites: ENGR 440

ENGR 452 (BIOE 452, CHE 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

ENGR 490 Thesis (Moc) 1 Credit

ENGR 492 (ARTS 492, BUS 492) Summer Research 1-3 Credits
Summer research experience designated for engineering graduate students at both the master's and doctoral level who are participating in full-time research during the entire summer semester. Students must have a summer research appointment to be eligible to enroll in this course. The course is repeatable, however, credits earned for this course cannot be used to fulfill degree requirements.
Repeat Status: Course may be repeated.

ENGR 499 Dissertation (Moc) 1 Credit

Data Science

OUR MISSION

To prepare students for a career in Data Science; to educate them in the scientific foundations and methodologies to understand, explore, process, and interpret data; to train them to apply data scientific tools to meet the challenges of the future; to promote a sense of scholarship, leadership and service among our graduates; to instill in the students the desire to create, develop, and disseminate new knowledge; and to produce international leaders in data science and its related professions.

MASTER OF SCIENCE IN DATA SCIENCE

The Master of Science in Data Science program provides students from a variety of backgrounds with a strong technical education in data scientific concepts and tools so that they may create innovative solutions to address societal challenges using data, state-of-the-art analytical methods and computing technology. Graduates from the program will gain proficiency required for positions in research and development within data science and its application in a variety of fields, and have the academic training to pursue doctoral research in or using data science.

Full-time students can complete the 30-credit program in as little as 11 months; part-time students may require up to 3 years. DSCI courses are available in person or online. A program of study must be submitted in compliance with college regulations.

Program Requirements
The program consists of:

DSCI Core Courses	21
Approved Electives	9
Total Credits	30

The seven required DSCI core courses are:

DSCI 310	Introduction to Data Science	3
DSCI 311	Optimization and Mathematical Foundations for Data Science	3
DSCI 321	Algorithms and Software Foundations for Data Science	3
DSCI 411 or DSCI 421	Data Management for Big Data Accelerated Computing for Machine Learning	3
DSCI 431	Introduction to Statistical Modeling	3
DSCI 441	Statistical and Machine Learning	3
DSCI 451	Ethics in Data Science	3

In addition to the core requirements, students are required to complete a minimum of 9 credits from a list of approved electives on the program website, at least 6 of which must be at the 400 level, and can optionally include up to six credits of thesis work. At most 3 courses (totaling 9 credits) from other programs can be applied towards the requirements of this program.

Recommended sequence of courses (1-Year ACCELERATED PROGRAM)

Summer Session II (July/August)

DSCI 310	Introduction to Data Science	3
DSCI 311	Optimization and Mathematical Foundations for Data Science	3

Fall Semester

DSCI 321	Algorithms and Software Foundations for Data Science	3
DSCI 431	Introduction to Statistical Modeling	3
DSCI 451	Ethics in Data Science	3
Approved Elective		3

Spring Semester

DSCI 411 or DSCI 421	Data Management for Big Data Accelerated Computing for Machine Learning	3
DSCI 441	Statistical and Machine Learning	3
Approved Elective		3
Approved Elective		3

RECOMMENDED SEQUENCE OF COURSES (1.5-YEAR PROGRAM)

Year 1 Summer Session II (July/August)

DSCI 311	Optimization and Mathematical Foundations for Data Science	3

Year 1 Fall Semester

DSCI 310	Introduction to Data Science	3
DSCI 321	Algorithms and Software Foundations for Data Science	3
DSCI 431	Introduction to Statistical Modeling	3

Year 1 Spring Semester

DSCI 411	Data Management for Big Data	3
or DSCI 421	Accelerated Computing for Machine Learning	
DSCI 441	Statistical and Machine Learning	3
Approved Elective		3

Year 2 Fall Semester

DSCI 451	Ethics in Data Science	3
Approved Elective		3
Approved Elective		3

GRADUATE CERTIFICATE IN DATA SCIENCE

The Graduate Certificate in Data Science program provides students with an introduction to the basic concepts and tools in data science. Individuals completing this program will be better positioned to understand and explore the application of data scientific concepts and methodologies in a variety of domains, or pursue more advanced training in Data Science or a field that requires a data scientific skillset. Upon completion of the certificate program, students can further enhance their knowledge and skills in the field by applying to the Master of Science in Data Science degree program and applying the 12 certificate credits towards the 30-credit Master's degree.

REQUIRED COURSES

Four courses (12 credits) are required in total for the certificate. Select two of the following 300-level fundamentals of data science courses (3 credits each):

DSCI 310	Introduction to Data Science	3
DSCI 311	Optimization and Mathematical Foundations for Data Science	3
DSCI 321	Algorithms and Software Foundations for Data Science	3

The remaining two courses are at the 400-level. Select one or two of the following 400-level core data science courses (3 credits each), and at most one course from a list of approved alternatives (also at the 400 level). Note that DSCI 431 and ECE 414 cannot both be chosen.

DSCI 411	Data Management for Big Data	3
DSCI 421	Accelerated Computing for Machine Learning	3
DSCI 431	Introduction to Statistical Modeling	3
DSCI 441	Statistical and Machine Learning	3
DSCI 451	Ethics in Data Science	3

Approved alternative courses include:

CSE 425	Natural Language Processing	3
CSE 447	Data Mining	3
CSE 449	Big Data Analytics	3
ECE 414	Statistical Decision Making and Machine Learning Theory	3
ECE 440	Introduction to Online and Reinforcement Learning	3
ISE 409	Time Series Analysis	3
ISE 410	Design of Experiments	3
ISE 444	Optimization Methods in Machine Learning	3
ISE 465	Applied Data Mining	3
STAT 439	Time Series and Forecasting	3

Generally, the 400-level courses will have prerequisites such that the 300-level courses are taken first, but there is no prescribed order for the courses.

An undergraduate minor in data science is offered within the Computer Science and Engineering Department.

Courses

DSCI 301 Mathematics for Data Science 3 Credits
Concepts from multivariable calculus, linear algebra/methods, statistics and probability as useful in a data science context. Course may not be taken for credit toward the MS in Data Science but can satisfy prerequisites.
Prerequisites: MATH 022 or MATH 032

DSCI 310 Introduction to Data Science 3 Credits
The computational analysis of data to extract knowledge and insight. Exploration and manipulation of data. Introduction to data collection and cleaning, reproducibility, code and data management, statistical inference, modeling, ethics, and visualization. Not available to undergraduate students.
Prerequisites: CSE 004 or CSE 007 or CSE 012 or BIS 335

DSCI 311 Optimization and Mathematical Foundations for Data Science 3 Credits
Introduction to optimization for data science. Topics in mathematical structures, linear modeling and matrix computation, and probabilistic thinking and modeling.
Prerequisites: DSCI 301

DSCI 321 Algorithms and Software Foundations for Data Science 3 Credits
Foundational computer science topics and software development in Python for data science. Concepts from discrete structures, algorithm design, programming concepts and data structures, object-oriented programming, exception handling, tools and environments, and scaling for big data.
Prerequisites: (CSE 004 or CSE 007 or CSE 012 or BIS 335) and (MATH 021 or MATH 031 or MATH 076)

DSCI 392 Independent Study 1-3 Credits
An intensive study, with report, of a topic in data science which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

DSCI 411 Data Management for Big Data 3 Credits
Modern distributed systems for big data. Systems and technology such as SQL, NoSQL, Hadoop, Spark. Data collection, cleaning, structuring and transforming data, data provenance.
Prerequisites: DSCI 310 and DSCI 321

DSCI 421 Accelerated Computing for Machine Learning 3 Credits
Introduction to hardware architectures and parallel computing systems that facilitate high speed machine learning. Graphics processing units (GPUs), hardware architecture of parallel computers, memory allocation and data parallelism, multidimensional kernel configuration, kernel-based parallel programming, principles and patterns of parallel algorithms, application of parallel computing to machine learning.
Prerequisites: DSCI 310 and DSCI 321

DSCI 431 Introduction to Statistical Modeling 3 Credits
Statistical analysis of data and linear models. Exploratory data analysis, graphical data analysis, estimation and hypothesis testing, Bayesian methods, simulation and resampling, linear, multivariate and generalized linear models, model selection and performance evaluation.
Prerequisites: DSCI 310 and DSCI 311

DSCI 441 Statistical and Machine Learning 3 Credits
Common machine learning methods, algorithmic analysis of models for scalability and implementation, data transformations (including dimension reduction, smoothing, aggregation), supervised and unsupervised learning, and ensemble methods.
Prerequisites: DSCI 310 and DSCI 321 and DSCI 431

DSCI 451 Ethics in Data Science 3 Credits
Legal and ethical considerations including privacy, reproducibility, bias, and fairness that are central to data science efforts, as well as ethical principles in information and technology research. Issues in real-world contexts. Development of technical solutions.
Prerequisites: DSCI 310 and DSCI 321

DSCI 480 Capstone Experience 3 Credits
Design, implementation, and evaluation of a data science project. Small student teams. Project definition, planning, data acquisition, analysis, evaluation, and documentation. Communication skills such as technical writing, oral presentation, and visualization.
Prerequisites: DSCI 311 and (DSCI 411 or DSCI 421)
Corequisites: DSCI 441 and DSCI 451

DSCI 490 Thesis 1-6 Credits
Thesis. Permission required.
Repeat Status: Course may be repeated.

DSCI 492 Independent Study 1-3 Credits
An intensive study, with report, of a topic in data science which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

Electrical Engineering and Engineering Physics

This dual-degree curriculum is particularly well suited for students seeking thorough preparation in the field of electronic device physics. It is a combination of the basic electrical engineering and engineering physics curricula and requires 162 credit hours, distributed over five years. The student will earn two degrees: B.S. in electrical engineering and B.S. in engineering physics.

Two alternative course sequences are listed below. Students who follow the EE-EP (EE first) course sequence will complete 135 credit hours, including all of the required electrical engineering courses, by the end of the fourth year and the remaining credit hours at the end of the fifth year. Since 134 credit hours are required for the electrical engineering degree, the student will complete the requirements for that degree at the end of the fourth year, and the requirements for the engineering physics degree at the end of the fifth year.

In the alternative EP-EE (EP first) course sequence, the student completes 133 credit hours by the end of the fourth year, including all the required physics courses, and the remaining credits at the end of the fifth year. Since 131 credit hours are required for the engineering physics degree, the student will complete the requirements for that degree at the end of the fourth year, and the requirements for the electrical engineering degree at the end of the fifth year.

Students interested in a dual-degree program combining physics (rather than engineering physics) and electrical engineering should consult the Physics section of this catalog. That program allows the student to earn the B.S. in physics and the B.S. in electrical engineering.

Students interested in either dual-degree program should contact Prof. Jerome Licini, Department of Physics.

THE RECOMMENDED SEQUENCES OF COURSES FOR THE TWO DIFFERENT EEEP SEQUENCES

EE-EP

First Year

First Semester	CR	Second Semester	CR
MATH 021	4	MATH 022	4
WRT 001	3	ENGR 005	2
ENGR 005	2	CHM 030 & ENGR 010	6
PHY 011 & PHY 012	5	WRT 002	3
	14		**15**

Second Year

First Semester	CR	Second Semester	CR
PHY 021 & PHY 022	5	PHY 031	3
ECE 033	4	ECE 121	2
ECE 081	4	ECE 123	3
MATH 023	4	MATH 205	3
		MATH 208	3
		HSS	4
	17		**18**

Third Year

First Semester	CR	Second Semester	CR
PHY 212	3	PHY 213	3
ECE 108	4	PHY 215	4
ECE 182	1	ECE 125	3
MATH 231	3	ECE 126	3
MATH 322	3	ECE 138	2
ECO 001	4	HSS	3
	18		**18**

Fourth Year

First Semester	CR	Second Semester	CR
PHY 362	3	ECE 258	2
PHY 363	3	ECE - Ap. Elec.	9
ECE 136	3	Electives	3
ECE 257	3	HSS	3
ECE - Ap. Elec.	3		
HSS	3		
	18		**17**

Fifth Year

First Semester	CR	Second Semester	CR
PHY 340 or ME 104	3	PHY 221	2
EP - Ap. Elec.	6	EP - Ap.Elec.	6
Electives	6	Electives	6
	15		**14**

Total Credits: 164

Credits in 4 yrs [135]

The EP-approved electives must include at least three courses from the following:

PHY 363	Physics of Solids	3
PHY 369	Quantum Mechanics II	3
PHY 352	Modern Optics	3
or PHY 355	Nonlinear Optics	
PHY 348	Plasma Physics	3
or PHY 365	Physics Of Fluids	
PHY 380	Introduction to Computational Physics	3

The ECE-approved electives must be approved by the student's advisor.

EP-EE

First Year

First Semester	CR	Second Semester	CR
MATH 021	4	MATH 022	4
WRT 001	3	WRT 002	3
ENGR 005	2	ENGR 005	2
PHY 011 & PHY 012	5	CHM 030 & ENGR 010	6
	14		**15**

Second Year

First Semester	CR	Second Semester	CR
PHY 021 & PHY 022	5	PHY 031	3
ECE 033	4	ECE 123 & ECE 121	5
ECE 081	4	MATH 205	3
MATH 023	4	MATH 208	3

		HSS	4
	17		**18**

Third Year

First Semester	CR	Second Semester	CR
PHY 212	3	PHY 213	3
ECE 108	4	PHY 215	4
ECE 182	1	PHY 221	2
MATH 322	3	ECE 125	3
ECO 001	4	ECE 126	3
EP - Ap. Elec.	3	HSS	3
	18		**18**

Fourth Year

First Semester	CR	Second Semester	CR
PHY 340 or ME 104	3	ECE 138	2
PHY 362	3	EP - Ap. Elec.	5
PHY 363	3	HSS	3
EP - Ap. Elec.	3	Electives	8
HSS	3		
	15		**18**

Fifth Year

First Semester	CR	Second Semester	CR
MATH 231	3	ECE 258	2
ECE 136	3	ECE - Ap. Elec.	9
ECE 257	3	Elective	4
ECE - Ap. Elec.	3		
Electives	3		
	15		**15**

Total Credits: 163

Credits in 4 yrs [133]

The EP-approved electives must include at least three courses from the following:

PHY 363	Physics of Solids	3
PHY 369	Quantum Mechanics II	3
PHY 352	Modern Optics	3
or PHY 355	Nonlinear Optics	
PHY 348	Plasma Physics	3
or PHY 365	Physics Of Fluids	
PHY 380	Introduction to Computational Physics	3

The ECE-approved electives must be approved by the student's advisor.

Electrical and Computer Engineering

WEBSITE: HTTPS://ENGINEERING.LEHIGH.EDU/ECE **(**https://engineering.lehigh.edu/ece/**)**

The department of electrical and computer engineering (ECE) offers undergraduate and graduate programs of study along with supporting research for students interested in the fields of electrical engineering and computer engineering. Graduate study leads to the degrees, master of science, master of engineering, and doctor of philosophy in electrical engineering, and the master of science and doctor of philosophy in computer engineering.

The undergraduate programs emphasize the fundamental aspects of their respective areas. Engineering design concepts are introduced early in the curriculum, and required instructional laboratories introduce design as a hands-on activity. Electives permit students to tailor their programs according to their interests and goals, whether they be in preparation for graduate study or entry into industry. Students are free to select courses offered by other departments and are encouraged to do so when appropriate. In this way they can prepare themselves for activities which straddle departmental boundaries or for entry into professional schools such as medicine or management. Students synthesize and apply their knowledge in a senior design project. Students may use the senior design project as a way to participate in the various research projects in the department.

The department maintains a number of laboratories in support of its curricular programs. These laboratories include the sophomore and junior lab, electronic circuits and systems laboratory, microcomputer laboratory, electromechanics laboratory, digital signal processing laboratory, digital systems laboratory and senior projects laboratories.

The department has research laboratories in computer architectures, wireless communications, optoelectronics, compound semiconductors, electron device physics, microelectronics fabrication, signal processing, and communications. These laboratories, among others, are available for undergraduate projects.

The graduate programs allow students to deepen their professional knowledge, understanding, and capability within their subspecialties. Each graduate student develops a program of study in consultation with his or her graduate advisor. Key research thrust areas in the department include:

1. Microelectronics and Nanotechnology.
2. Wireless Communications and Networking.
3. Optoelectronics.
4. Bio-Engineering.

Graduate research is encouraged in these and other areas.

Computers and computer usage are an essential part of the student's learning experience. The university provides a distributed network of about 75 high-performance workstations and over 300 PC-compatible microcomputers in public sites throughout the campus. The ECE department has state-of-the-art systems to augment and extend the generally available university systems. There are approximately 90 Workstations running the Microsoft and Linux platforms that are located in various ECE Teaching Labs. Additionally, there is an ECE Teaching Lab Linux Platform with over 40 servers that are used both for graduate research and to augment classroom learning. The systems provide an array of software for students and researchers, such as Cadence, Synopsys, Silvaco, Anaconda/Python, Nvidia CUDA Development Kit, Matlab, LabView, Xilinx, and many open source applications. The ECE Department workstations and servers are connected via high speed ethernet, which are in turn connected to the university's backbone network, and to the external world through the internet. 2. Students are not required by the department, nor the university, to own a personal computer, but many find such a tool a valuable asset.

A detailed description of the curricular programs follows with a listing of the required courses and with a listing of the departmental course offerings. The departmental courses carry the prefix ECE for electrical and computer engineering. Courses given by the Computer Science and Engineering department have the prefix CSE. Students are urged to search both listings for courses appropriate to their career goals.

UNDERGRADUATE PROGRAMS

Mission Statement for the Electrical Engineering Program

The mission of the electrical engineering and computer engineering programs is to prepare engineers to meet the challenges of the future, to promote a sense of scholarship, leadership, and service among our graduates, to instill in the students the desire to create, develop, and disseminate new knowledge, and to provide international leadership to the electrical engineering and computer engineering professions.

Program Educational Objectives in Electrical Engineering

It is expected that our alumni will:

1. Be valued as dependable and technically proficient electrical engineers across a wide variety of fields, industries, non-profit organizations, national laboratories, entrepreneurial endeavors or in the pursuit of graduate education;
2. Pursue life-long learning and professional development to advance their knowledge and skills for successful and rewarding careers,

3. function and communicate effectively individually and in a team environment, contribute to multi-disciplinary projects, and attain leadership positions in their chosen profession, communities, and the global society, and
4. function as responsible members of society with an awareness of the professional responsibilities and the global, social and the ethical ramifications associated with their work.

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

The required courses for this degree contain the fundamentals of linear circuits, systems and control theory, electronic circuits, signal theory, physical electronics, electromagnetic theory, energy conversion, digital systems, and computing techniques. A strong foundation in the physical sciences and in mathematics is required. Approved electives, chosen with the advisor's consent, are selected in preparation for graduate study or entry into industry according to individual interests. The program requires a minimum of 125 credit hours. The recommended sequence of courses follows:

First Year

First Semester	Credits	Second Semester	Credits
MATH 021	4	MATH 022	4
WRT 001	3	WRT 002	3
ENGR 005	2	HSS Elective or ECO 001	3-4
Select one of the following:	5-6	Select one of the following:	5-6
CHM 030 & ENGR 010[1]		CHM 030 & ENGR 010[1]	
PHY 011 & PHY 012[1]		PHY 011 & PHY 012[1]	
	14-15		**15-17**

Second Year

First Semester	Credits	Second Semester	Credits
ECE 033	4	ECE 121	2
ECE 081	4	ECE 123	3
PHY 021 & PHY 022	5	ECE 126	3
MATH 023	4	ECE 108	4
		MATH 205	3
	17		**15**

Third Year

First Semester	Credits	Second Semester	Credits
ECE 125	3	ECE 132	3
ECE 182	1	ECE 203	3
ECE 200	1	ECE 205	3
ECE 202	3	approved technical elective[2]	6
MATH 231	3	HSS ELECTIVE	3
HSS elective or ECO 001	4		
	15		**18**

Fourth Year

First Semester	Credits	Second Semester	Credits
ECE 257	3	ECE 258	2
HSS elective	4	approved technical electives[2]	6
approved technical electives[2]	6	HSS elective	4
free elective	3	free elective	3
	16		**15**

Total Credits: 125-128

1

Required natural science courses, one taken fall semester and the other taken in spring

2

Approved technical electives are subjects in the area of science and technology. Students must select a minimum of four courses (totaling at least 12 credits) from the ECE or CSE course listings, with a minimum of two courses in one of the technical areas described in the following list. Students must also choose at least one engineering elective in either materials, mechanics, thermodynamics, fluid mechanics or physical chemistry, and at least one science elective in physics, chemistry or biology. For students interested in solid-state electronics, quantum mechanics is recommended for the science elective.

Approved Technical Electives for Electrical Engineering

Requirement

Minimum of 4 ECE or CSE elective courses chosen from the new areas below.

Circuits and Power		
ECE 310	Wireless Circuits	3
ECE 313	Power Electronics	3
ECE 328	Electricity Economics	3
ECE 321	Introduction to Power Systems	3
ECE 322	Introduction to Photovoltaic Energy Systems	3
ECE 332	Design of Linear Electronic Circuits	3
ECE 333	Medical Electronics	3
ECE 337	Introduction to Micro- and Nanofabrication	3
ECE 355	Mixed Signal Circuits	3
ECE 361	Introduction to VLSI Circuits	3
ECE 363	Computer-Aided Design of Digital Systems	3
ECE 366	Neural Engineering	3
Communications and Cyber Physical Systems		
ECE 212	Control Theory	3
ECE 327	Communications & Networking for Smart Grids	3
ECE 339	Graphical Signal Processing	3
ECE 341	Fundamentals of Wireless Communications	3
ECE 342	Communication Theory	3
ECE 345	Fundamentals of Data Networks	
ECE 364	Introduction to Cryptography and Network Security	3
ECE 387	Digital Control	3
ECE 389	Control Systems Laboratory	2
Semiconductor Devices and Photonics		
ECE 308	Physics and Models of Electronic Devices	3
ECE 309	Applied Quantum Engineering	3
ECE 325	Semiconductor Lasers I	3
ECE 348	Fundamentals of Photonics	3
ECE 368	Introduction to Biophotonics and Optical Biomedical Imaging	3
ECE 375	Semiconductor Optoelectronics	3
Learning and Artificial Intelligence		
ECE 303	Accelerated Computing for Deep Learning	3
ECE 306	Autonomous Driving and Robotic Racing	3
ECE 340	Introduction to Online and Reinforcement Learning	3

ECE 343	Digital Signal Processing	3
ECE 344	Statistical Signal Processing	3
Computers		
Any CSE course except CSE 002, CSE 012, CSE 015, or CSE 252		
ECE 201	Computer Architecture	3
ECE 303	Accelerated Computing for Deep Learning	3
ECE 305	Memory Systems	3
ECE 306	Autonomous Driving and Robotic Racing	3
ECE 319	Digital System Design	3
ECE/CSE 336	Embedded Systems	3
ECE 340	Introduction to Online and Reinforcement Learning	3
ECE 345	Fundamentals of Data Networks	
ECE 364	Introduction to Cryptography and Network Security	3

Note: Special Topics (3) (The area of each course must be evaluated individually)

MINOR IN ELECTRICAL ENGINEERING

The purpose of the Electrical Engineering minor is to enable students to supplement their major with knowledge and skills that increase their ability to realize their multi-disciplinary goals and/or make them more marketable upon graduation.

Required Courses		
ECE 081	Principles of Electrical Engineering [1]	4
or ECE 083 & ECE 162	Introduction to Electrical Engineering and Electrical Laboratory	
ECE 108	Signals and Systems [2]	4
ECE 121	Electronic Circuits Laboratory	2
ECE 123	Electronic Circuits	3
Select one of the following Electrical and Computer Engineering Courses or Other Approved Elective:		3-4
ECE 033	Introduction to Computer Engineering	
ECE 125	Random Signals and Learning	
ECE 126	Fundamentals of Semiconductor Devices	
ECE 136	Electromechanics	
ECE 339	Graphical Signal Processing	
ECE 341	Fundamentals of Wireless Communications	
ECE 343	Digital Signal Processing	
ECE 371	Optical Information Processing	
ECE 372	Optical Networks	
Total Credits		**16-17**

1

ECE 083 and ECE 162 plus departmental approval.

2

Mechanical Engineering substitute ME 245 Engineering Vibrations for ECE 108, by petition, but must select an additional ECE elective. Because of similar course requirements between electrical and computer engineering majors, computer engineering students wishing to minor in electrical engineering can use one required course in their major and must choose four electives, excluding required courses, from the above list to satisfy the requirements of the electrical engineering minor. Computer engineering technical electives (chosen from the above list) can be used to satisfy the requirements of the minor.

Technical minors must be declared by the end of pre-registration of the student's sixth semester. If course requirements change or a student wishes to vary the list of courses above, a revised minor declaration form must be submitted.

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

See catalog entry for Computer Engineering (p. 434).

GRADUATE PROGRAMS

Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student's professional goals. The programs appeal to individuals with backgrounds in electrical or computer engineering, mathematics, or the physical sciences. Research is an essential part of the graduate program. Major research areas include:

Microelectronics Devices, Integrated Circuits, VLSI Design

Mixed Signal design, Silicon integrated circuit technology, processing, fabrication and testing. Semiconductor device physics, nano scale devices, CMOS VLSI logic design and verification, computer-aided design (CAD), VLSI chip architectures, computer architecture including embedded systems and systems-on-a-chip. New sensors, actuators and novel microsystems, ranging from micro-electromechanical-systems (MEMS) to chemical microreactors and Biochips.

Optoelectronics and Photonics

Fiber optic communications and networks, applications of nonlinear optics, optical switching, novel devices, and optical computing. Freespace optical communication systems. Terahertz generation, amplification, detection, and applications, nanostructures and nanodevices. Biophotonics.

The Master of Science degree requires the completion of 30 credit hours of work that may include a six credit thesis or a six credit independent study. A program of study must be submitted in compliance with the graduate school regulations.

The ECE Department has a core curriculum requirement for graduate students in each of the degree programs. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the department acquire an appropriate breadth of knowledge of their discipline. To satisfy the core curriculum requirements in Electrical Engineering:

Select three courses from the following five different areas:		
ECE 401	Advanced Computer Architecture	3
ECE 402	Advanced Electromagnetics	3
ECE 414	Statistical Decision Making and Machine Learning Theory	3
or ECE 441	Fundamentals of Wireless Communications	
ECE 420	Advanced Circuits and Systems	3
ECE 451	Physics of Semiconductor Devices	3

The Master of Engineering degree requires the completion of 30 credit hours of work that may include six credits of independent study. A program of study must be submitted in compliance with the graduate school regulations.

The Ph.D. degree in electrical engineering requires the completion of 42 credit hours of work (including the dissertation) beyond the master's degree (48 hours if the master's degree is non-Lehigh), the passing of a departmental qualifying examination appropriate to each degree within one year after entrance into the degree program, the passing of a general examination in the candidate's area of specialization, the admission into candidacy, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The ECE Department has a core curriculum requirement for graduate students in each of the degree programs. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the department acquire an appropriate breadth of knowledge of their discipline.

Electrical Engineering

To satisfy the core curriculum requirements in Electrical Engineering:

Select three courses from the following five different areas:		9
ECE 401	Advanced Computer Architecture	
ECE 402	Advanced Electromagnetics	

ECE 414	Statistical Decision Making and Machine Learning Theory	
or ECE 441	Fundamentals of Wireless Communications	
ECE 420	Advanced Circuits and Systems	
ECE 451	Physics of Semiconductor Devices	
Total Credits		**9**

Computer Engineering

See catalog entry for Computer Engineering (p. 434).

M.S. in Photonics

The Masters of Science degree in Photonics is an interdisciplinary degree that is designed to provide students with a broad training experience in the various aspects of photonics, including topics in Physics, Electrical Engineering and Materials Science and Engineering. It covers both theoretical and practical topics in areas such as fiber optics, integrated optics, lasers, nonlinear optics and optical materials to prepare the students to work in industry directly after graduation. The program is also designed so as to make it possible for students who wish to continue on for a Ph.D. to still satisfy the requirements of their individual departments for the more advanced degree. For details on this program, see the separate catalog section under Interdisciplinary Graduate Study and Research.

DEPARTMENTAL COURSES

Courses are listed under the prefixes ECE and CSE. Generally, electrical engineering courses carry the ECE prefix and appear in the following listing. Computer science courses carry the CSE prefix. Computer engineering courses are found under either prefix. The CSE courses are listed in the Computer Science and Engineering department section in this catalog. The reader should consult both listings.

Courses

ECE 033 Introduction to Computer Engineering 0,4 Credits
Analysis, design and implementation of small digital circuits. Boolean algebra. Minimization techniques, synchronous sequential circuit design, number systems and arithmetic. Microcomputer architecture and assembly level programming.
Prerequisites: CSE 017 or ENGR 010 or ENGR 097

ECE 081 Principles of Electrical Engineering 0,4 Credits
Circuit elements and laws. Behavior of simple linear networks, include equivalent circuits and solution techniques. Solution of DC circuits and AC circuits using phasor techniques. Introduction to operational amplifiers. Steady state and transient response of simple circuits. Includes a weekly session for review and discussion. May not be taken with ECE 083 for credit.
Prerequisites: (MATH 022 or MATH 096) and PHY 021
Can be taken Concurrently: PHY 021

ECE 083 Introduction to Electrical Engineering 3 Credits
Circuit elements and laws. Behavior of simple linear networks. Characteristics of electronic circuits and modeling. Introduction to functional circuits, such as operational amplifiers, instrumentation amplifiers, and power systems. Introduction to basic filters and data converters. May not be taken with ECE 081 for credit.
Prerequisites: MATH 022 and PHY 021
Can be taken Concurrently: PHY 021

ECE 108 Signals and Systems 0,4 Credits
Continuous and discrete signal and system descriptions using signal space and transform representations. Includes Fourier series, continuous and discrete Fourier transforms, Laplace transforms, and z-transforms. Introduction to sampling.
Prerequisites: ECE 081

ECE 121 Electronic Circuits Laboratory 0,2 Credits
One lecture and one laboratory per week. Experiments illustrating the principles of operation of electronic devices and their circuit applications. Basic electronic instrumentation and measurement techniques.
Prerequisites: ECE 081

ECE 123 Electronic Circuits 3 Credits
Methods for analyzing and designing circuits containing electronic devices. Topics include device models, basic amplifier configurations, operating point stabilization, frequency response analysis, and computer-aided analysis of active circuits.
Prerequisites: ECE 081

ECE 125 Random Signals and Learning 3 Credits
Introduction to random signals and analysis of linear time invariant (LTI) system response to random inputs. Modeling LTI systems using state space approach. Introduction to inference and learning, including basics of signal detection and estimation, linear regression, and linear time series models.
Prerequisites: ECE 108 and (MATH 231 or MATH 263)
Can be taken Concurrently: MATH 231, MATH 263

ECE 126 Fundamentals of Semiconductor Devices 3 Credits
Introduction to the physics of semiconductors in terms of atomic bonding and electron energy bands in solids. Charge carriers in semiconductors and carrier concentration at thermal equilibrium. Principles of electron and hole transport, drift and diffusion currents, generation and recombination processes, continuity. Treatment of semiconductor devices including p-n junctions, bipolar junction transistors and field effect transistors.
Prerequisites: ECE 081

ECE 128 FPGA Laboratory 0,3 Credits
Implementation issues and techniques for digital logic design; combinational and sequential logic design using digital ICs; hardware description languages; field programmable gate arrays (FPGAs); designs with modular building blocks; and functional simulations will be covered in this course.
Prerequisites: ECE 033

ECE 132 Microcontroller Laboratory 0,3 Credits
Basic digital logic and circuitry. Architecture of microcontrollers. Number conversion and data encoding in microcontrollers. Input and output of microcontrollers. Timers and interrupt routines. Serial communication protocols. Data acquisition, control, sensors, and actuators. Basic software techniques of programming microcontrollers.
Prerequisites: ECE 033

ECE 136 Electromechanics 0-3 Credits
Two lectures and one laboratory per week. An experimental introduction to electromechanical energy conversion. Basic concepts of magnetic fields and forces and their application to electrical apparatus including electromechanical transducers, transformers, AC and DC machines.
Prerequisites: ECE 081

ECE 138 Digital Systems Laboratory 2 Credits
Implementation issues and techniques for digital logic design. Combinational and sequential logic design using standard integrated circuits. I/O and interrupt processing. Design and implementation of real-time complex digital logic using microprocessor systems.
Prerequisites: ECE 033

ECE 162 Electrical Laboratory 1 Credit
Experiments on circuits, machines, and electronic devices. Elementary network theory. Survey laboratory for students not majoring in electrical or computer engineering.
Prerequisites: ECE 081 or ECE 083
Can be taken Concurrently: ECE 081, ECE 083

ECE 182 Junior Laboratory 1 Credit
Experiments designed to exploit the students understanding of basic circuits and filters. Experiments designed to help students understand basic signals and systems concepts such as time-frequency domain duality, power measurement, modulation, sampling and data conversion. Students are introduced to a variety of integrated circuits including multipliers, analog switches, digital electronics, S/H, A/D, and D/A converters. Computer software design aids, especially Spice and LabView, are used throughout the semester. One three-hour laboratory per week.
Prerequisites: ECE 033 and ECE 121 and ECE 123

ECE 200 Electrical and Computer Engineering Seminar 1 Credit
This course provides a comprehensive overview of the field of Electrical and Computer Engineering. Different research areas in the field will be discussed through weekly seminars. The seminars will cover relevant and cutting edge topics in signal processing and machine learning, communication and cyber physical systems, high performance computing and computing architectures, semiconductors and quantum engineering, electronic circuits and power systems, and bio-electrical engineering.

ECE 201 Computer Architecture 3 Credits
Structure and function of digital computers. Computer components and their operations. Computer interconnection structures. Memory system and cache memory. Interrupt driven input/output and direct memory access. Instruction sets and addressing modes. Instruction pipelining. Floating-point representation and arithmetic. Alternative architectures: RISC vs. CISC and introduction to parallel architectures.
Prerequisites: ECE 033

ECE 202 Introduction to Electromagnetics 3 Credits
Elements of vector analysis, Coulomb's law, Biot-Savart's and Ampere's laws, Lorentz Forces, Laplace's, and Maxwell's equations, boundary conditions, methods of solution in static electric and magnetic fields, including finite element numerical approach. Quasistationary fields, inductance.
Prerequisites: MATH 205 and PHY 021

ECE 203 Introduction to Electromagnetic Waves 3 Credits
Uniform plane waves in free space and in materials, skin effect. Waves in transmission lines and waveguides, including optical fibers. Energy and power flow, Poynting's theorem. Reflection and refraction. Resonators. Radiation and diffraction.
Prerequisites: ECE 202

ECE 205 C/C++ Programming 3 Credits
Introduction to C/C++ programming language and algorithms to solve engineering problems. Topics include data types, operators, flow control statements, loops, functions, structures, classes, and search and sort algorithm. Several programming projects are assigned throughout the course.
Prerequisites: ENGR 010

ECE 212 Control Theory 3 Credits
Introduction to feedback control. Dynamic analysis of linear feedback systems in the time and frequency domain, with emphasis on stability and steady-state accuracy. Major analytical tools: signal-flow graphs, root-locus methods. Nyquist plot, Bode analysis. Cascade compensation techniques.
Prerequisites: ECE 125

ECE 256 Honors Project 1 Credit
Open by invitation only to students who have completed ECE 257, Senior Project. Selection is based upon the quality of the senior project with regard to ingenuity, design approach and completeness. The objective of this course is to carry the successful senior projects forward to completion of a technical paper suitable for publication or submission to a technical conference. A written paper and oral presentation are required by mid-semester. Oral presentations will be made before an appropriate public forum. Enrollment limited.

ECE 257 Senior Lab I 3 Credits
With ECE 258, provides a complete design experience for Electrical and Computer Engineers. Students are expected to identify essential project aspects crucial to success and to perform in-depth engineering evaluation and testing demonstrating that desired results can be achieved with the proposed implementation. Instruction in technical writing, product development, ethics and professional engineering, and presentation of design and research. Two three hour sessions and one additional two hour lecture per week. Must have senior status.

ECE 258 Senior Lab II 2 Credits
Continuation of ECE 257. Complete design, construction, and testing of projects selected and developed in ECE 257. Present final design reviews and project presentations. Submit a final written report. Discuss development issues, including manufacturability, patents, and ethics. Two three-hour sessions per week.
Prerequisites: ECE 257

ECE 300 Apprentice Teaching 1-4 Credits

ECE 303 Accelerated Computing for Deep Learning 3 Credits
Graphics Processing Unit (GPU) versus Computer Processing Unit (CPU), hardware architecture of parallel computers, memory allocation and data parallelism, multidimensional kernel configuration, kernel-based parallel programming, principles and patterns of parallel algorithms, application of parallel computing to deep learning neural networks. Deep Learning (DL) algorithms, such as Convolutional Neural Networks (CNN), Stochastic Gradient Descent, and back propagation algorithms. Credit will not be given for both ECE 303 and ECE 403.
Prerequisites: (ECE 201 or CSE 202) and (MATH 231 or MATH 309)

ECE 305 Memory Systems 3 Credits
Cache and memory internal implementations, timing constraints, high-performance memory controllers, advanced memory interfaces, emerging memory technologies, 3D stacked memories, and processing-in-memory architectures. Reviews of state-of-the-art research topics on energy, performance, and reliability issues in cache and memory systems.
Prerequisites: ECE 201

ECE 306 Autonomous Driving and Robotic Racing 0,3 Credits
Basic framework of autonomous robots; drive train, vehicle controls, and dynamics models; perception subsystems including sensors such as sonar, Lidar, camera, or inertial measurement units (IMU); Robotic Operating Systems (ROS), racing simulators, autonomous driving methods including reactive and deliberative methods; simultaneous localization and mapping (SLAM); path planning and race-line optimization; learning and vision with image classification and obstacle detection.
Prerequisites: ECE 108 and (MATH 205 or CSE 140)

ECE 308 Physics and Models of Electronic Devices 3 Credits
Physics of metal-semiconductor junction, p-n junctions, and MOS capacitors. Models of Schottky barrier and p-n junction diodes, JFET, MOSFET, and bipolar transistors.
Prerequisites: ECE 126

ECE 310 Wireless Circuits 3 Credits
Theory and design of high-frequency circuits for wireless communications. Transmission lines and microwave networks. Types of circuits explored include filters, amplifiers, mixers, voltage controlled oscillators (VCOs), phase locked loops (PLLs), synthesizers, modulators and demodulators, and antennae. Design using scattering parameters, Smith chart and RF/microwave CAD programs for simulation. System performance analysis based on noise figure, antenna gain and the Friis equation will be developed. Modulation techniques of AM, FM, PM, and QPSK systems will be compared based on bit error rates (BER) calculated from system parameters.
Prerequisites: ECE 203

ECE 313 Power Electronics 3 Credits
Introduction to power semiconductor devices, circuits, and applications. Diodes, thyristors, bipolar and MOS transistors, IGBTs, and other emerging types, and their use in typical power conversion circuits such as rectifiers, buck and boost converters, and dc-dc, dc-ac, and ac-ac inverters and converters. Application examples in motor drives, power supplies and HVDC transmission.
Prerequisites: ECE 081

ECE 314 Statistical Decision Making and Machine Learning Theory 3 Credits
To teach the statistical theory describing the performance of general Machine Learning and Statistical Decision Making approaches. We will not attempt to describe details of specific machine learning algorithms, code those algorithms and test them on real data. Students will learn some needed hypothesis testing theory and estimation theory that is necessary to understand learning theory. Students will learn Probably Approximately Correct learning theory. Credit will not be given for both ECE 314 and ECE 414.
Prerequisites: ECE 108 and (MATH 231 or MATH 309)

ECE 318 INTRODUCTION TO INTERNET OF THINGS 3 Credits
Basic framework of the Internet of Things (IoT) including both hardware and software, with principles and applications. Principles cover IoT architecture, embedded systems, technology standards, wireless protocols, and device and network cybersecurity. Application aspects include hands-on experiments with IoT devices, power consumption and low-power modes, sensors and actuators, narrowband Radio Frequency (RF) communications, and IoT applications. Credit will not be given for both ECE 318 and ECE 418.
Prerequisites: ECE 132 or ECE 108 or ECE 201 or CSE 202

ECE 319 Digital System Design 3 Credits
Design techniques at the register transfer level. Control strategies for hardware architectures. Implementation of microprogramming, intersystem communication and peripheral interfacing. Hardware design languages and their use in design specification, verification and simulation.
Prerequisites: ECE 132

ECE 321 Introduction to Power Systems 3 Credits
Power systems engineering relating to generation, transmission, distribution and utilization of electric power. This course introduces basic yet critical concepts of large-scale power systems. Topics include power system modeling, power flow, symmetrical faults, unsymmetrical faults, transient stability, and optimal power flow. Subject material is useful to students who pursue careers or research in electric power systems.
Prerequisites: ECE 123

ECE 322 Introduction to Photovoltaic Energy Systems 3 Credits
Basic principles for design, installation, and operation of photovoltaic energy systems. Properties of sunlight and physics of photovoltaic cells. Photovoltaic cells, modules, and arrays. Inverters and other system components. Site assessment. Design and installation of grid-connected and stand-alone PV systems. Systems operation. Maintenance, performance, and economic analysis. Relevant design and simulation tools are introduced.
Prerequisites: ECE 081

ECE 325 Semiconductor Lasers I 3 Credits
Review of elementary solid-state physics. Relationships between Fermi energy and carrier density and leakage. Introduction to optical waveguiding in simple double-heterostructures. Density of optical modes, Blackbody radiation and the spontaneous emission factor. Modal gain, modal loss, and confinement factors. Einstein's approach to gain and spontaneous emission. Periodic structures and the transmission matrix. Ingredients. A phenomenological approach to diode lasers. Mirrors and resonators for diode lasers. Gain and current relations. Credit will not be given for both ECE 325 and ECE 425.
Prerequisites: ECE 203

ECE 326 Semiconductor Lasers II 3 Credits
Continuation of Semiconductor Lasers I. Topics covered include: Gain and current relations; dynamic effects; perturbation and coupled-mode theory; dielectric waveguides; and photonic integrated circuits. Credit will not be given for both ECE 326 and ECE 426.
Prerequisites: ECE 325

ECE 327 Communications & Networking for Smart Grids 3 Credits
Overview of smart grid electricity systems. Concepts covered include power system background and operations, electricity markets, legacy grid communications, and the smart grid vision and objectives. Additional focus on relevant communications and networking technologies that enable smart grid applications, such as real-time grid monitoring, automated control, demand response, distributed energy systems, microgrids, vehicle-to-grid integration, and smart homes and buildings. Credit will not be given for both ECE 327 and ECE 427.
Prerequisites: ECE 108

ECE 328 (ECO 328) Electricity Economics 3 Credits
The course is intended primarily for students who are interested in an exploration of electricity markets around the world, risk management, operation, and the main considerations in the wake of a smart grid implementation as well as in the transition to a low carbon economy.
Repeat Status: Course may be repeated.
Prerequisites: ECO 001 and (MATH 023 or ECO 146)
Attribute/Distribution: CC, Q, SS

ECE 329 Power System Modeling and Computation 3 Credits
A comprehensive study of various computational methods that form the basis of many analytical studies of power systems. Topics include power system modeling, solution of linear systems, systems of nonlinear equations, sparse matrix solution techniques, numerical integration, optimization, and their applications in power system analysis. Students are enabled to make informed decisions in their use of commercial software packages and correctly interpret the results. Matlab is used extensively. ECE 329 and ECE 429 may not both be taken for credit.
Prerequisites: ECE 136 or ECE 321 or ECE 421

ECE 332 Design of Linear Electronic Circuits 3 Credits
Introduction to a variety of linear design concepts and topologies, with audio networks providing many of the concrete examples. Topics include preamplifiers, equalizers and filters, multipliers, voltage-controlled amplifiers, level detectors, and power amplifiers.
Prerequisites: ECE 123 and ECE 125
Can be taken Concurrently: ECE 125

ECE 333 Medical Electronics 3 Credits
Bioelectric events and electrical methods used to study and influence them in medicine, electrically excitable membranes, action potentials, electrical activity of muscle, the heart and brain, bioamplifiers, pulse circuits and their applications.
Prerequisites: ECE 123

ECE 336 (CSE 336) Embedded Systems 3 Credits
Use of small computers embedded as part of other machines. Limited-resource microcontrollers and state machines from high level description language. Embedded hardware: RAM, ROM, flash, timers, UARTs, PWM, A/D, multiplexing, debouncing. Development and debugging tools running on host computers. Real-Time Operating System (RTOS) semaphores, mailboxes, queues. Task priorities and rate monotonic scheduling. Software architectures for embedded systems.
Prerequisites: CSE 017

ECE 337 Introduction to Micro- and Nanofabrication 3 Credits
Survey of the standard IC fabrication processes, such as photolithography, dry and wet etching, oxidation, thin-film deposition and chemical mechanical polishing. In-depth analysis of MEMS-specific processes such as wafer bonding, wet anisotropic etching, photolithography using thick photoresist, and deep reactive ion etching of silicon. The basics of nanofabrication techniques. The fundamentals of MEMS design will be outlined. A wide variety of MEMS and NEMS devices will be discussed.
Prerequisites: (MAT 033 and MATH 231) or ECE 351

ECE 338 Quantum Electronics 3 Credits
Electromagnetic fields and their quantization. propagation of optical beams in homogeneous and lens-like media. Modulation of optical radiation. Coherent interactions of radiation fields and atomic systems. Introduction to nonlinear optics-second-harmonic generation. Parametric amplification, oscillation, and fluorescence. Third-order optical nonlinearities. Credit will not be given for both ECE 338 and ECE 438.
Prerequisites: ECE 203

ECE 339 Graphical Signal Processing 3 Credits
Application of graphical programming to mathematical principles in data analysis and signal processing. Review of digital signal processing, use of structures, arrays, charts, building virtual instruments, graphical programming for linear algebra, curve fitting, solving differential and difference equations, signal generation, DFT and FFT analysis, windowing and filtering.
Prerequisites: ECE 108

ECE 340 Introduction to Online and Reinforcement Learning 3 Credits
Review of probability and random processes, basic reinforcement learning framework, learning from streaming data, actions in response to changing environment through Markov Decision Processes, elements of artificial intelligence. Exploration-Exploitation tradeoffs through bandit problems, and different methods for reinforcement learning including dynamic programming, Monte Carlo methods, temporal difference and Q-learning. Approximate solutions for very large state space systems, policy iteration and actor critic methods, introduction of deep reinforcement learning. Credit will not be given for both ECE 340 and ECE 440.
Prerequisites: MATH 231 or MATH 309

ECE 341 Fundamentals of Wireless Communications 3 Credits
Overview of wireless communication systems basics. Cellular concept and other wireless systems. System design fundamentals. Mobile Radio Propagation Modeling: Flat, Frequency Selective, Fast, Slow fading channels, Path Loss Models. Multiple access. Modulation Techniques for wireless. Introduction to wireless networking. Wireless systems and standards. Future wireless systems.
Prerequisites: ECE 108

ECE 342 Communication Theory 3 Credits
Theory and application of analog and digital modulation. Sampling theory with application to analog-to-digital and digital-to-analog conversion techniques. Time and frequency division multiplexing. Introduction to random processes including filtering and noise problems. Introduction to statistical communication theory with primary emphasis on optimum receiver principles.
Prerequisites: ECE 108 and (MATH 309 or MATH 231)

ECE 343 Digital Signal Processing 3 Credits
Study of orthogonal signal expansions and their discrete representations, including the Discrete Fourier Transform and Walsh-Hadamard Transform. Development of fast algorithms to compute these, with applications to speech processing and communication. Introduction to the z-transform representation of numerical sequences with applications to input/output analysis of discrete systems and the design of digital filters. Analysis of the internal behavior of discrete systems using state variables for the study of stability, observability and controllability.
Prerequisites: ECE 108

ECE 344 Statistical Signal Processing 3 Credits
Introduction to random processes, covariance and spectral density, time average, stationarity, and ergodicity. Response of systems to random inputs. Sampling and quantization of random signals. Optimum filtering, estimation, and hypothesis testing.
Prerequisites: (ECE 108) and (MATH 231 or MATH 309)

ECE 345 Fundamentals of Data Networks 3 Credits
Analytical foundations in the design and evaluation of data communication networks. Fundamental mathematical models underlying network design with their applications in practical network algorithms. Layered network architecture, queuing models with applications in network delay analysis, Markov chain theory with applications in packet radio networks and dynamic programming with applications to network routing algorithms. Background on stochastic processes and dynamic programming will be reviewed. Prereq: MATH 231 and ECE125.
Prerequisites: MATH 231 and ECE 125

ECE 347 Introduction to Integrated Optics 3 Credits
Theory of dielectric waveguides (ray and wave approach). Modes in planar slab optical guides and in waveguides with graded index profiles. Coupled-mode formalism and periodic structures. Coupling of optical beams to planar structures. Switching and modulation of light in dielectric guides: phase, frequency and polarization modulators; electro-optic, acousto-optic and magneto-optic modulators. Semiconductor lasers. Fabrication of semiconductor components. Recent advances.
Prerequisites: (ECE 202 and ECE 203)

ECE 348 Fundamentals of Photonics 3 Credits
Concepts of generation, transmission, modulation, and detection of electromagnetic-waves. Paraxial rays and Gaussian beams in uniform media. Wave propagation in integrated waveguides and optical-fibers. Optical-cavity resonators. Light-matter interaction, absorption and amplification of radiation, spontaneous and stimulated-emission. Theory of laser-oscillation and linewidth-narrowing. Wave propagation in anisotropic media. Optical components such as waveplates, optical-couplers and isolators, electro-optic modulators, and photodetectors. Devices with periodic media such as Bragg-reflectors and distributed-feedback lasers. Credit will not be given for both ECE 348 and ECE 448.
Prerequisites: ECE 203

ECE 350 Special Topics 3 Credits
Selected topics in the field of electrical and computer engineering not included in other courses.
Repeat Status: Course may be repeated.

ECE 355 Mixed Signal Circuits 3 Credits
Analysis and design of contemporary mixed signal electronic circuits, including phase-locked loops, A/D and D/A converters, sigma-delta converters, and switching power supplies. Continuous and discrete time simulation of mixed signal systems starting with operational amplifiers as a prototype feedback system using Spice and Matlab.
Prerequisites: ECE 108 and ECE 123

ECE 361 Introduction to VLSI Circuits 3 Credits
The design of Very Large Scale Integrated (VLSI) Circuits, with emphasis on CMOS Standard Cell design. Topics include MOS transistor physics, device behavior and device modeling, MOS technology and physical layout, design of combinational and sequential circuits, static and dynamic memories, and VLSI chip organization. The course includes a design project using CAE tools for layout, design rule checking, parameter extraction, and SPICE simulations for performance prediction. Two one-hour lectures and three hours of laboratory per week.
Prerequisites: ECE 123

ECE 363 Computer-Aided Design of Digital Systems 0,3 Credits
Modern digital chip design, with emphasis on key design concepts, methodology and flow using state-of-the-art electronic design automation (EDA) tools and standard cell libraries from the semiconductor industry. Topics include CMOS transistor operations, interconnect, dynamic/leakage power, delay, RTL coding, logic synthesis, static timing analysis, formal verification, RTL/gate level simulation and physical design. The course consists of a set of labs and a project built upon multiple Synopsys EDA tools, including Design Compiler, PrimeTime, Formality, VCS etc.
Prerequisites: ECE 033

ECE 364 Introduction to Cryptography and Network Security 3 Credits
Introduction to cryptography, classical cipher systems, cryptanalysis, perfect secrecy and the one time pad, DES and AES, public key cryptography covering systems based on discrete logarithms, the RSA and the knapsack systems, and various applications of cryptography. May not be taken with ECE 464 for credit. Must have junior or senior standing.

ECE 366 (BIOE 366) Neural Engineering 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 366, BIOE 466, and ECE 466.
Prerequisites: ECE 081

ECE 368 (BIOE 368) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken ECE 468, BIOE 368, or BIOE 468.
Prerequisites: ECE 202 or PHY 212

ECE 371 Optical Information Processing 3 Credits
Introduction to optical information processing and applications. Interference and diffraction of optical waves. 2D optical matched filters that use lenses for Fourier transforms. Methods and devices for modulating light beams for information processing, communications, and optical computing. Construction and application of holograms for optical memory and interconnections.
Prerequisites: (ECE 108 and ECE 202)

ECE 372 Optical Networks 3 Credits
Study the design of optical fiber local, metropolitan, and wide area networks. Topics include: passive and active photonic components for optical switching, tuning, modulation and amplification; optical interconnection switches and buffering; hardware and software architectures for packet switching and wavelength division multiaccess systems. The class is supported with a laboratory.
Prerequisites: (ECE 081 and ECE 202)

ECE 375 Semiconductor Optoelectronics 3 Credits
Theory and practical implementation of semiconductor optoelectronic devices. Broad coverage of the fundamentals of the propagation, modulation, generation, and detection of light. Topics include the energy transfer between photons and electron-hole pairs, light emission and absorption, radiative and non-radiative processes, electrical and optical characteristics, carrier diffusion and mobility, light extraction and trapping. Specific devices include laser diodes, light-emitting diodes, electroabsorption modulators, photodetectors, and solar cells. Credit will not be given for both ECE 375 and ECE 475.
Prerequisites: ECE 126 and ECE 202

ECE 387 (CHE 387, ME 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane; root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Liapunov stability; state feedback control.
Prerequisites: CHE 386 or ECE 212 or ME 343

ECE 389 (CHE 389, ME 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state of the art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary.
Prerequisites: CHE 386 or ECE 212 or ME 343

ECE 392 Independent Study 1-3 Credits
An intensive study, with report of a topic in electrical and computer engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

ECE 401 (CSE 401) Advanced Computer Architecture 3 Credits
Design, analysis and performance of computer architectures; high-speed memory systems; cache design and analysis; modeling cache performance; principle of pipeline processing, performance of pipelined computers; scheduling and control of a pipeline; classification of parallel architectures; systolic and data flow architectures; multiprocessor performance; multiprocessor interconnections and cache coherence.
Prerequisites: ECE 201

ECE 402 Advanced Electromagnetics 3 Credits
Maxwell's equations for various media and boundary geometries. Electromagnetic wave propagation through anisotropic and nonlinear media. Guided waves, layered media and resonators. Radiation, antennas, strong and weak scattering. Scalar and vector diffraction, and periodic structures. Numerical solutions for boundary value problems.
Prerequisites: (ECE 202 and ECE 203)

ECE 403 Accelerated Computing for Deep Learning 3 Credits
Graphics Processing Unit (GPU) versus Computer Processing Unit (CPU), hardware architecture of parallel computers, memory allocation and data parallelism, multidimensional kernel configuration, kernel-based parallel programming, principles and patterns of parallel algorithms, application of parallel computing to deep learning neural networks. Deep Learning (DL) algorithms, such as Convolutional Neural Networks (CNN), Stochastic Gradient Descent, and back propagation algorithms. Credit will not be given for both ECE 303 and ECE 403.
Prerequisites: (ECE 201 or CSE 202) and (MATH 231 or MATH 309)

ECE 404 (CSE 404) Computer Networks 3 Credits
Study of architecture and protocols of computer networks. The ISO model; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local area networks; network interconnection; topics in security and privacy.

ECE 405 Memory Systems 3 Credits
Cache and memory internal implementations, timing constraints, high-performance memory controllers, advanced memory interfaces, emerging memory technologies, 3D stacked memories, and processing-in-memory architectures. Reviews of state-of-the-art research topics on energy, performance, and reliability issues in cache and memory systems. Credit may not be given for both ECE 305 and ECE 405.
Prerequisites: ECE 201

ECE 406 Autonomous Driving and Robotic Racing 0,3 Credits
Basic framework of autonomous robots; drive train, vehicle controls, and dynamics models; perception subsystems including sensors such as sonar, Lidar, camera, or inertial measurement units (IMU); Robotic Operating Systems (ROS), racing simulators, autonomous driving methods including reactive and deliberative methods; simultaneous localization and mapping (SLAM); path planning and race-line optimization; learning and vision with image classification and obstacle detection. This course is a version of ECE306 for graduate students. Credit will not be given for both ECE306 and ECE406.
Prerequisites: ECE 108 and (MATH 205 or CSE 140)

ECE 411 Information Theory 3 Credits
Introduction to information theory. Topics covered include: development of information measures for discrete and continuous spaces study of discrete-stochastic information courses, derivation of noiseless coding theorems, investigation of discrete and continuous memoryless channels, development of noisy channel coding theorems.

ECE 413 Power Electronics 3 Credits
Introduction to power semiconductor devices, circuits, and applications. Diodes, thyristors, bipolar and MOS transistors, IGBTs, and other emerging types, and their use in typical power conversion circuits such as rectifiers, buck and boost converters, and dc-dc, dc-ac, and ac-ac inverters and converters. Application examples in motor drives, power supplies and HVDC transmission. This course, a version of ECE 313 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 313 and ECE 413.
Prerequisites: ECE 081

ECE 414 Statistical Decision Making and Machine Learning Theory 3 Credits
To teach the statistical theory describing the performance of general Machine Learning and Statistical Decision Making approaches. We will not attempt to describe details of specific machine learning algorithms, code those algorithms and test them on real data. Students will learn some needed hypothesis testing theory and estimation theory that is necessary to understand learning theory. Students will learn Probably Approximately Correct learning theory. Credit will not be given for both ECE 314 and ECE 414.
Prerequisites: ECE 108 and (MATH 231 or MATH 309)

ECE 416 VLSI Signal Processing 3 Credits
The fundamentals of performance-driven VLSI systems for signal processing. Analysis of signal processing algorithms and architectures in terms of VLSI implementation. VLSI design methodology. Includes a design project which requires use of a set of tools installed on SUN workstations for behavioral simulation, structural simulation, circuit simulation, layout, functional simulation, timing and critical path analysis, functional testing, and performance measurement.

ECE 418 INTRODUCTION TO INTERNET OF THINGS 3 Credits
Basic framework of the Internet of Things (IoT) including both hardware and software, with principles and applications. Principles cover IoT architecture, embedded systems, technology standards, wireless protocols, and device and network cybersecurity. Application aspects include hands-on experiments with IoT devices, power consumption and low-power modes, sensors and actuators, narrowband Radio Frequency (RF) communications, and IoT applications. This course is a version of ECE 318 for graduate students. Credit will not be given for both ECE 318 and ECE 418.

ECE 420 Advanced Circuits and Systems 3 Credits
Review of the fundamentals of Circuits and Systems theory, including the time and frequency domain response of linear time-invariant circuits. Equation formulation for general lumped circuits, including node voltage and loop current analysis. Basic graph theoretic properties of circuits including Tellegen's Theorem. Discussion of passivity and reciprocity including multiport network properties. State space formulation and solution of general circuits (and systems). Modern filter concepts, including synthesis techniques for active filters and externally linear filters, such as Log Domain filters. Techniques for the analysis of weakly nonlinear systems, as time permits. Must have graduate standing.
Prerequisites: ECE 125

ECE 421 Introduction to Power Systems 3 Credits
Power systems engineering relating to generation, transmission, distribution and utilization of electric power. This course introduces basic yet critical concepts of large-scale power systems. Topics include power system modeling, power flow, symmetrical faults, unsymmetrical faults, transient stability, and optimal power flow. This course, a version of ECE 321 for graduate students, requires research projects and advanced assignments. ECE 321 and ECE 421 may not both be taken for credit.
Prerequisites: ECE 123

ECE 422 Introduction to Photovoltaic Energy Systems 3 Credits
Basic principles for design, installation, and operation of photovoltaic energy systems. Properties of sunlight and physics of photovoltaic cells. Photovoltaic cells, modules, and arrays. Inverters and other system components. Site assessment. Design and installation of grid-connected and stand-alone PV systems. Systems operation. Maintenance, performance, and economic analysis. Relevant design and simulation tools are introduced. This course, a version of ECE 321 for graduate students, requires research projects and advanced assignments. Credit not given for both ECE322 and ECE422.
Prerequisites: ECE 081

ECE 425 Semiconductor Lasers I 3 Credits
Review of elementary solid-state physics. Relationships between Fermi energy and carrier density and leakage. Introduction to optical waveguiding in simple doubleheterostructures. Density of optical modes, Blackbody radiation and the spontaneous emission factor. Modal gain, modal loss, and confinement factors. Einstein's approach to gain and spontaneous emission. Periodic structures and the transmission matrix. Ingredients. A phenomenological approach to diode lasers. Mirrors and resonators for diode lasers. Gain and current relations. This course, a version of ECE 325 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 325 and ECE 425.
Prerequisites: ECE 203

ECE 426 Semiconductor Lasers II 3 Credits
Continuation of Semiconductor Lasers I. Topics covered include: Gain and current relations; dynamic effects; perturbation and coupled-mode theory; dielectric waveguides; and photonic integrated circuits. This course, a version of ECE326 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 326 and ECE 426.
Prerequisites: ECE 203

ECE 427 Communications & Networking for Smart Grids 3 Credits
Overview of smart grid electricity systems. Concepts covered include power system background and operations, electricity markets, legacy grid communications, and the smart grid vision and objectives. Additional focus on relevant communications and networking technologies that enable smart grid applications, such as real-time grid monitoring, automated control, demand response, distributed energy systems, microgrids, vehicle-to-grid integration, and smart homes and buildings. This course is a version of ECE327 for graduate students. Credit will not be given for both ECE327 and ECE427.
Prerequisites: ECE 108

ECE 428 (ECO 428) Electricity Economics 3 Credits
Course focuses on the intersection between economics & electricity systems, and market structures available in the electric energy industry. Background provided on basic economic theory applied to power systems to understand operations objectives, pricing & incentives, as well as non-perfect competition situations that arise in the network. Different dispatch optimization problems used in electricity market restructuring, approaches to solving these, and the existence of non-convex markets will be discussed. Credit will not be given for both ECO/ECE328 and ECO/ECE428.

ECE 429 Power System Modeling and Computation 3 Credits
A comprehensive study of various computational methods that form the basis of many analytical studies of power systems. Topics include power system modeling, solution of linear systems, systems of nonlinear equations, sparse matrix solution techniques, numerical integration, optimization, and their applications in power system analysis. Students are enabled to make informed decisions in their use of commercial software packages and correctly interpret the results. Matlab is used extensively. ECE 329 and ECE 429 may not both be taken for credit.
Prerequisites: ECE 136 or ECE 321 or ECE 421

ECE 432 Spread Spectrum and CDMA 3 Credits
Fading and dispersive channel model, direct sequence spread spectrum, frequency hopping spread spectrum, DS-CDMA, FH-CDMA, spread sequences and their properties, multi-user detection, PN code acquisition, wireless communication systems, industrial standards (IS-95, WCDMA, CDMA2000).

ECE 433 (CHE 433, ME 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations, Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability, Canonical forms, minimal realizations, introduction to optimal control theory, Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers.
Prerequisites: ME 343 or ECE 212 or CHE 386

ECE 434 (CHE 434, ME 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special attention is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures.
Prerequisites: CHE 433 or ME 433 or ECE 433

ECE 435 Error-Correcting Codes 3 Credits
Error-correcting codes for digital computer and communication systems. Review of modern algebra concentrating on groups and finite fields. Structure and properties of linear and cyclic codes for random or burst error correction covering Hamming, Golay, Reed-Muller, BCH and Reed-Solomon codes. Decoding algorithms and implementation of decoders.

ECE 436 (CHE 436, ME 436) Systems Identification 3 Credits
The determination of model parameters from time-history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant-imbedding techniques for nonlinear system parameter identification included.
Prerequisites: ECE 433 or ME 433 or ECE 433

ECE 438 Quantum Electronics 3 Credits
Electromagnetic fields and their quantization. propagation of optical beams in homogeneous and lens-like media. Modulation of optical radiation. Coherent interactions of radiation fields and atomic systems. Introduction to nonlinear optics-second-harmonic generation. Parametric amplification, oscillation, and fluorescence. Third-order optical nonlinearities. This course, a version of ECE 338 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 338 and ECE 438.

ECE 440 Introduction to Online and Reinforcement Learning 3 Credits
Review of probability and random processes, basic reinforcement learning framework, learning from streaming data, actions in response to changing environment through Markov Decision Processes, elements of artificial intelligence. Exploration-Exploitation tradeoffs through bandit problems, and different methods for reinforcement learning including dynamic programming, Monte Carlo methods, temporal difference and Q-learning. Approximate solutions for very large state space systems, policy iteration and actor critic methods, introduction of deep reinforcement learning. Credit will not be given for both ECE 340 and ECE 440.
Repeat Status: Course may be repeated.
Prerequisites: MATH 231 or MATH 309

ECE 441 Fundamentals of Wireless Communications 3 Credits
Characterization of mobile radio channels. Wireless information transmission: modulation/demodulation, equalization, diversity combining, coding/decoding, multiple access methods. Overview of cellular concepts and wireless networking. This course, a version of ECE 341 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 341 and ECE 441.
Prerequisites: ECE 342 or ECE 342

ECE 443 RF Power Amplifiers for Wireless Communications 3 Credits
Review of linear power amplifier design. Discussion of major nonlinear effects, such as high-efficiency amplifiers modes, matching network design for reduced conduction angle, overdrive and limiting effects, and switching mode amplifiers. Discussion of other nonlinear effects, efficiency enhancement and linearization techniques. Companion course to ECE 463.

ECE 445 Fundamentals of Data Networks 3 Credits
This course provides analytical foundations in the design and evaluation of data networks. Graphical and dynamical models underlying network design will be discussed with applications in practical networks such as the Internet and Social Media. Key topics covered include queuing, Dynamic Programming, Optimization and Auctions with application in network delay analysis, packet routing, cellular networking, and social media advertising. Background on probability and random processes will be reviewed. Credit will not be given for both ECE 345 and ECE 445.
Prerequisites: (MATH 231 or MATH 309) and ECE 108
Can be taken Concurrently: MATH 231, MATH 309

ECE 448 Fundamentals of Photonics 3 Credits
Concepts of generation, transmission, modulation, and detection of electromagnetic-waves. Paraxial rays and Gaussian beams in uniform media. Wave propagation in integrated waveguides and optical-fibers. Optical-cavity resonators. Light-matter interaction, absorption and amplification of radiation, spontaneous and stimulated-emission. Theory of laser-oscillation and linewidth-narrowing. Wave propagation in anisotropic media. Optical components such as waveplates, optical-couplers and isolators, electro-optic modulators, and photodetectors. Devices with periodic media such as Bragg-reflectors and distributed-feedback lasers. Credit will not be given for both ECE 348 and ECE 448.

ECE 450 Special Topics 1-3 Credits
Selected topics in electrical and computer engineering not covered in other courses.
Repeat Status: Course may be repeated.

ECE 451 Physics of Semiconductor Devices 3 Credits
Crystal structure and space lattices, crystal binding, lattice waves and vibrations, electrons and atoms in crystal lattices. Quantum mechanics and energy band theory, carrier statistics, Boltzmann transport theory, interaction of carriers with scattering centers, electronic and thermal conduction. Magnetic effects. Generation and recombination theory. Application to p-n junctions.
Repeat Status: Course may be repeated.
Prerequisites: ECE 126

ECE 454 Turbo Codes and Iterative Decoding 3 Credits
Capacity-approaching error correcting codes. Soft-in soft-out iterative decoding. Parallel/serial/hybrid concatenated convolutional codes—and turbo-like codes. Iterative decoding algorithms and performance analysis of parallel/serial turbo codes. Low density parity check (LDPC) codes and product codes. Code graph and message passing decoding algorithms. Turbo and LDPC code design and construction. Performance analysis using density evolution and extrinsic information transfer charts. Applications of turbo and LDPC codes.

ECE 455 Theory of Metal Semiconductor and Heterojunction Transistors 3 Credits
Physics of metal semiconductor and heterojunction field effect transistors (MESFET and HEMT). Theory of semiconductor heterojunctions. Properties of heterojunction bipolar transistors (HBT): Equivalent circuits, applications to microwave amplifiers, oscillators, and switching circuits.

ECE 460 Engineering Project 3-6 Credits
Project work in an area of student and faculty interest. Selection and direction of the project may involve interaction with industry. Consent of department required.

ECE 463 Design of Microwave Solid State Circuits 3 Credits
Equivalent circuit modeling and characterization of microwave semiconductor devices, principles of impedance matching, noise properties and circuit interaction, introduction to the design of high power and non-linear circuits.

ECE 464 Introduction to Cryptography and Network Security 3 Credits
Introduction to cryptography, classical cipher systems, cryptanalysis, perfect secrecy and the one time pad, DES and AES, public key cryptography covering systems based on discrete logarithms, the RSA and the knapsack systems, and various applications of cryptography. This graduate version of ECE 364 requires additional work. May not be taken with ECE 364 for credit. Must have graduate student status.

ECE 465 VLSI Implementation of Error Control Coding 3 Credits
Error control coding, finite field arithmetic, encoding and decoding of BCH and Reed-Solomon codes, efficient iterative decoders for convolutional and Turbo codes, message passing and high performance decoders for low-density parity-check codes.
Prerequisites: ECE 435

ECE 466 (BIOE 466) 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 366, ECE 366, or BIOE 466. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

ECE 468 (BIOE 468) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken BIOE 468, ECE 368, or ECE 468. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

ECE 471 Optical Information Processing 3 Credits
Introduction to optical information processing and applications. Interference and diffraction of optical waves. 2D optical matched filters that use lenses for Fourier transforms. Methods and devices for modulating light beams for information processing, communications, and optical computing. Construction and application of holograms for optical memory and interconnections. The course is an extension of ECE 371 for graduate students and it will include research projects and advanced assignments.
Prerequisites: (ECE 108)

ECE 472 Optical Networks 3 Credits
Study the design of optical fiber local, metropolitan, and wide area networks. Topics include: passive and active photonic components for optical switching, tuning, modulation and amplification; optical interconnection switches and buffering; hardware and software architectures for packet switching and wavelength division multiaccess systems. This class is supported with a laboratory. The course is an extension of ECE 372 for graduate students and it will include research projects and advanced assignments.
Prerequisites: ECE 081

ECE 475 Semiconductor Optoelectronics 3 Credits
Theory and practical implementation of semiconductor optoelectronic devices. Broad coverage of the fundamentals of the propagation, modulation, generation, and detection of light. Topics include the energy transfer between photons and electron-hole pairs, light emission and absorption, radiative and non-radiative processes, electrical and optical characteristics, carrier diffusion and mobility, light extraction and trapping. Specific devices include laser diodes, light-emitting diodes, electroabsorption modulators, photodetectors, and solar cells. Credit will not be given for both ECE 375 and ECE 475.

ECE 485 Heterojunction Materials and Devices 3 Credits
Material properties of compound semiconductor heterojunctions, quantum wells and superlattices. Strained layer epitaxy and band-gap engineering. Theory and performance of novel devices such as quantum well lasers, resonant tunneling diodes, high electron mobility transistors, and heterojunction bipolar transistors. Complementary to ECE 452.
Prerequisites: ECE 451

ECE 490 Thesis 1-6 Credits

ECE 491 Research Seminar 1-3 Credits
Regular meetings focused on specific topics related to the research interests of department faculty. Current research will be discussed. Students may be required to present and review relevant publications. Consent of instructor required.
Repeat Status: Course may be repeated.

ECE 492 Independent Study 1-3 Credits
An intensive study, with report, of a topic in electrical and computer engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

ECE 493 Solid-State Electronics Seminar 3 Credits
Discussion of current topics in solid-state electronics. Topics selected depend upon the interests of the staff and students and are allied to the research programs of the Sherman Fairchild Laboratory for Solid State Studies. Student participation via presentation of current research papers and experimental work. Consent of instructor required.
Repeat Status: Course may be repeated.

ECE 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Energy Systems Engineering

MASTER OF ENGINEERING IN ENERGY SYSTEMS ENGINEERING

For students with B.S. degrees in engineering, physics, computer science, mathematics, business, finance and related fields, Lehigh's 30-credit professional Master's program in Energy Systems Engineering helps students develop into organizational and technical leaders in the energy and power industries. Full-time students complete the program in 10 months, part-time students will complete in up to 3 years. Learning takes place in an environment where potential employers actively guide curricular development and student research endeavors. Graduates of this program emerge with the skills and confidence to tackle the grand challenges facing the global energy infrastructure and its associated effect on the environment.

The hallmark of the program is student immersion in hands-on, industry-driven projects. Each student will apply advanced technical knowledge and skills and work collaboratively with a team of faculty, fellow students, and representatives from sponsor firms to complete a project of impact and significance in the field — a real project as conceptualized by the project's sponsoring researcher or industry concern. The development of targeted research projects serves as an entry point into the field for talented young innovators, and a source for firms to explore new skill sets and solutions required for success with emerging technologies and approaches.

The basic 30 credit hour course sequence consists of:

ESE Core Courses	18
ESE Technical Electives	6

ESE Industry Project	6
Total credits	30

Full-time students typically begin this 10 month program in Summer Session II and will graduate spring of the following year with a Master of Engineering degree in Energy Systems Engineering.

Further information can be obtained from:
https://ese.lehigh.edu

Program Director
Energy Systems Engineering
P.C. Rossin College of Engineering & Applied Science
(610) 758-3529

Ms. Susan Kanarek
Graduate Coordinator
P.C. Rossin College of Engineering & Applied Science
Energy Systems Engineering
(610) 758-3650

Recommended sequence of courses in the ESE M.Eng. program

Summer Session II (Late June/August)

Summer		Credits
ESE 403	Energy and the Environment	3
ESE 405	Energy Systems Project Management	3
Total Credits: 6		

Fall Semester

Fall		Credits
ESE 401	Energy Generation	3
ESE 460	Energy Systems Engineering Project	3
Technical Electives (2)		**6**
Total Credits: 12		

Spring Semester

Spring		Credits
ESE 402	Transmission and Distribution	3
ESE 460	Energy Systems Engineering Project *	3
Technical Electives (2)*		**6**
Total Credits: 12		

*Student may choose to take a third technical elective instead of ESE 460 in the Spring semester with the approval of the program Director.

Students acquire a level of specialized knowledge and experience through the completion of four to five technical electives courses. The electives should reflect the student's career interest. Below is the list of departments from which the technical electives are drawn from. The full list of technical electives for each department listed below is available online at: www.lehigh.edu/esei/electives (http://www.lehigh.edu/esei/electives/). Other electives may be considered with the approval of the program Director.

- Two (2) electives must be 400 level courses and
- Three (3) electives must be in the P.C. Rossin College of Engineering and Applied Science.

Technical Elective Department List:

Engineering

- Chemical Engineering
- Civil & Environmental Engineering
- Computer Science & Engineering
- Electrical & Computer Engineering
- Industrial & Systems Engineering
- Materials Science & Engineering
- Mechanical Engineering & Mechanics

Business and Science

- Chemistry
- Earth & Environmental Science
- Economics
- Environmental Studies
- International Relations
- Physics
- Political Science

Courses

ESE 401 Energy Generation 3 Credits
This course provides an overview of the different methods of generating electricity, such as turbine driven electrochemical generators, fuel cells, photovoltaics, and thermoelectric devices. Topics include the combustion of fossil fuels (coal, natural gas, and oil), nuclear fission and fusion, and renewable resources (solar, wind, hydro, tidal, and geothermal sources). Sustainability, energy efficiency issues, as well as public interest and policy drivers are also addressed.

ESE 402 Transmission & Distribution: Smart Grid 3 Credits
This course provides an overview of modern power transmission and distribution systems. Topics include transformer technology, transmission grids, load management, distribution optimization, power supply reliability, and infrastructure systems. Security and deregulation issues are also addressed.

ESE 403 Energy And The Environment 3 Credits
This course provides an overview of the direct and indirect impact of energy generation and transmission technologies on the environment. Topics include global climate change, clean energy technologies, energy conservation, air pollution, water resources, and nuclear waste issues.

ESE 405 Energy Systems Project Management 3 Credits
This course introduces students to the basics of project management in the field of energy systems, which includes the broad spectrum of empirical, theoretical and policy issues of managing the electric power grid, its generation facilities and equipment. This focuses on the key elements of case studies in engineering that focus on the effective project management of tomorrow's intelligent energy system.

ESE 460 Energy Systems Engineering Project 3-6 Credits
A collaborative and intensive study in an area of energy systems over 2 semesters on an industry-sponsored project worth 6 credits. The selected project consider themes of current interest: the use of renewable energy, and efficient planning and development of energy communities to reduce carbon footprint. The student applies principles of energy project management in the planning, execution and completion. The student presents their results at the end of each semester to an audience of peers, faculty & industry personnel.
Repeat Status: Course may be repeated.

ESE 461 Energy Seminars and Field Trips 3 Credits
This course provides a rich mix of presentations and field trips from industry experts in current energy technologies and challenges as the industry strives to decarbonize. The topics include the role of central generation facilities—the bulwark and working horse for over a century—over the next decade, how climate change targets would require decarbonizing some key industries and exploration of alternative clean fuels, and the role of the utility customer who is increasingly a partner of the modern grid.

Engineering

P.C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE

The P.C. Rossin College of Engineering and Applied Science offers the Bachelor of Science degree in 17 programs, combining a strong background in sciences and mathematics with requirements in humanities and social sciences. Students in the Rossin College programs learn principles they can apply immediately in professional work; those who plan on further academic experience can design a curriculum centering on interests they will pursue in graduate school.

The mission of the college is to prepare undergraduate and graduate students to be critical thinkers, problem solvers, innovators, leaders, and life-long learners in a global society and to create an environment where students pursue cutting-edge research in engineering and engineering science.

The Rossin College provides many opportunities for study in a wide variety of fields. In addition, multiple technical minors and interdisciplinary opportunities exist. The Rossin College also offers an accelerated path towards a master's degree. See this page (https://engineering.lehigh.edu/academics/undergraduate/special-opportunities/accelerated/) for more information.

See additional information on the P.C. Rossin College of Engineering and Applied Science (p. 400).

ENGINEERING MINOR

See additional information on the Engineering Minor under the heading of the P.C. Rossin College of Engineering and Applied Science (p. 400).

Students will need to have completed the following core prerequisites to begin the program.

CALCULUS	
MATH 051 OR MATH 021 OR MATH 031 OR MATH 081 OR equivalent	
SCIENCE	
PHYS 005 OR PHYS 011 OR CHM 30 OR BIOS 41 OR equivalent	

The Engineering Minor will require 15 credits:

General Requirements

ENGR 005	Introduction to Engineering Practice	2
ENGR 010	Applied Engineering Computer Methods	2
Principles of Design		3-6
At least 3 credits (up to 6 credits) from the following:		
ENGR 089, ENGR 211, TE 250		

Students then can choose from the following options

Biological, Chemical, and Materials	
5-8 credits from the following list: BIOE 110, MAT 028, MAT 033, BIOE 210, CHE 171, CHE 179, CHE 367/ BIOE 367, BIOE 225, BIOE 369/CHE 369, BIOC 237, ENGR 212, or other courses in an engineering department by approval	
Mechanical, Electrical, and Manufacturing Track	
5-8 credits from the following list: MAT 028, MAT 033, MECH 002, ECE 083, ISE 168, ISE 215, ECE 328, CHE 179, BIOE 225, ISE 131 and ISE 132, ISE 334, ENGR 212, or other courses in an engineering department as approved.	
Computational Track	
5-8 credits from the following list: ISE 111, CSE 003 (and CSE 004) OR CSE 007, CSE 012, ISE 172, ISE 224, ISE 230, ISE 364, ISE 365, ISE 367, ENGR 212, or other courses in an engineering department as approved.	
Infrastructure and Sustainability Track	
5-8 credits from the following list: CHE 171, CEE 003, CEE 010, CEE 170, CEE 202, ECE 328, ENGR 212, or other courses in an engineering department as approved.	
Develop your own track	
Students may select any combination of the courses above, or a combination of courses in an engineering discipline as approved by the Rossin College, leading to 15 credits.	

Students may substitute up to 3 credits of the courses above with an appropriate CINQ project.

Number of credits to fulfill minor is 15 credits

Note: The Minor in Engineering is not open to RCEAS students or students in CSB, IBE, or IDEAS.

Engineering Minor Course Courses

EMC 001 Macro and Micro View of Engineering 3 Credits
A course designed to be exciting and stimulate a student's further interest in the engineering minor. Hands-on experience with engineering problem solving, modeling, simulation, and analysis tools. Macro view of what engineering is and what engineers do. Interaction with practicing engineers; visits to local engineering facilities.

EMC 002 Engineering Practicum 3 Credits
Techniques and processes used in the creation of engineered products. Exposure to engineering tasks and processes in a hands-on laboratory; mechanical and electronic manufacturing and fabrication techniques. Disassembly and reassembly of common engineered products to assess how they work and are manufactured.

EMC 042 (CSE 042) Game Design 3 Credits
From the early text-based, one-player computer games to the modern 3D games with thousands of gamers sharing the same virtual gaming world simultaneously, computer games have gone through a remarkable evolution. Despite this evolution, principles of computer game design are not well understood. In this course we will study the broad issue of game design, particularly tailored towards video games. We will present an experimental model for game design and analyze various modern computer games from the perspective of this model.

EMC 105 Engineering Structures and Motion 3 Credits
Practical limits imposed on stationary or moving structures; why exceeding these limits can lead to failure. Basic principles governing both stationary structures; e.g. buildings and bridges, and things that move, e.g. cars and satellites, and how these principles apply in engineering practice. How a stationary structure effectively supports both its own weight and the weight of its users and why a structure will undergo deflections and deformations during use. How forces and energy are associated with a moving structure and how these affect the motion of the structure.

EMC 110 Energy Engineering 3 Credits
The amount of energy used by a modern society is quite staggering, and a clear understanding of energy processes and constraints is essential knowledge for every citizen. The basics of energy, its measurement, principles governing its use and conversion, methods of production, and the associated consequences on the environment. Fossil, nuclear, and renewable, energy sources. Energy utilization developed in a simple form and employed to examine the use of energy in large and small engineering systems and products, from power plants to air conditioners.

EMC 115 Engineering Materials and Electronics 3 Credits
"Materials" are the "stuff" from which we build TV's, cell phones, cars, skyscrapers, etc., and affect design, performance, costs, and environmental impacts. How electronics, communications, and structures depend on advances in materials engineering: materials behavior, modeling and simulation of materials properties and performance; methods and databases for materials selection; and engineering processes to control material composition and structure.

EMC 120 Systems Engineering 3 Credits
Systems approach to problem solving in fields such as environmental planning, large-scale infrastructure systems, manufacturing, telecommunication, and delivery of services. Systems analysis concepts and their relation to the determination of preferred plans and designs of complex, large-scale engineering systems. Performance and cost in project engineering decisions that balance resource investments across the major stages of life of an engineering system. Development of functional requirements and satisfactory designs.

EMC 150 Information and Knowledge Engineering 3 Credits
How computers manage information for making decisions automatically or for advising decision makers. Characterization of database systems, of web technologies, of multimedia, and of the relationships among them. Representations of knowledge and the use of artificial intelligence techniques. Automated help-desk systems and computer generation of project plans.

EMC 155 Enterprise Engineering 3 Credits
The key elements of modeling and engineering the corporation. Enterprise engineering, decision analysis, application of quantitative methods to facilities planning, engineering economy, production planning and control, forecasting, material requirements planning, and agile business practices.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 156 Embedded Systems 3 Credits
Use of small computers embedded as part of other machines. Limited resource microcontrollers and state machines from high-level description language. Embedded hardware: RAM, ROM, flash, timers, UARTs, PWM, A/D, multiplexing, debouching. Development and debugging tools running on host computers. Real-Time Operating System (RTOS) semaphores, mailboxes, queues. Task priorities and rate monotonic scheduling. Software architectures for embedded systems.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 160 Computer Aided Engineering and Control Systems 3 Credits
Use of computer-based technologies to design and manufacture products. The design cycle to create product concepts. Analysis of product design. Specifications for the control of manufacturing processes. How control systems are used in creating agile manufacturing environments: discrete and analog signals, analog to digital conversion, and application case studies. Hands-on application(s) and sample exercises from real world examples.

EMC 168 Production Analysis 3 Credits
A course for students not majoring in industrial engineering. Engineering economy; application of quantitative methods to facilities analysis and planning, operations planning and control, work measurement, and scheduling.

EMC 170 Software Engineering and Collaborative Environments 3 Credits
Discover why building large software systems is very different from using large databases, or designing products such as automobiles with CAD, etc. Design and implementation of a large team project involving complex data management in a collaborative environment. Learn why and how collaborative environments are becoming essential to modern engineering projects and require the tools and techniques of software engineering to succeed.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 171 (CEE 171, CHE 171) Fund of Environmental Technology 4 Credits
Water and air quality; water, air, and soil pollution. Chemistry of common pollutants. Water purification, wastewater treatment, solid and hazardous waste management, environmental remediation, and air quality control. Global changes, energy, and the environment. Constraints of environmental protection on technology development and applications. Constraints of economic development on environmental quality. Environmental life cycle analysis and environmental policy.

EMC 174 Process Engineering 3 Credits
Semiconductor process engineering, including technology to process raw silicon wafer to electronics integrated circuits (ICs). Crystal growth, thin film deposition, photolithography, doping technology.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 252 (CSE 252) Computers, the Internet, and Society 3 Credits
An interactive exploration of the current and future role of computers, the Internet, and related technologies in changing the standard of living, work environments, society and its ethical values. Privacy, security, depersonalization, responsibility, and professional ethics; the role of computer and Internet technologies in changing education, business modalities, collaboration mechanisms, and everyday life.
Attribute/Distribution: SW, W

EMC 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

Engineering Courses

ENGR 005 Introduction to Engineering Practice 0,2 Credits
First year practical engineering experience; introduction to concepts, methods and principles of engineering practice. Problem solving, design, project planning, communication, teamwork, ethics and professionalism; innovative solution development and implementation. Introduction to various engineering disciplines and degree programs. Mandatory for first year RCEAS students.

ENGR 010 Applied Engineering Computer Methods 0,2 Credits
Introduction to programming for engineering tasks. Use of programming tools to solve engineering problems. Interfacing sensors and actuators to a microcontroller board and programming to interact with the world. Computer lab setting. Final project controls engineering equipment.
Attribute/Distribution: ND

ENGR 050 Directed Study 1-3 Credits
Engineering project work either as an individual or team member. Projects directed by faculty within the Rossin College of Engineering and Applied Science with possible interaction from outside consultants, community and industry leaders. Written report required. RCEAS permission required.
Repeat Status: Course may be repeated.

ENGR 089 Introduction to Design Thinking for Innovation 3 Credits
Design Thinking is a proven process for identifying problems and creating solutions to address them. Key tools and terminology of Design Thinking and related processes that encourage creativity as a way to innovate will be explored. The emphasis is on learning by doing and focuses on practicing the 5 steps in Design thinking: Empathize, Define, Ideate, Prototype, Test that can be applied to virtually any area where new solutions are needed.

ENGR 130 Engineering Communications 1 Credit
Experience and theory in oral and written communications preparing students for their first Co-Op work assignments. Required of all Engineering Co-Op students.
Prerequisites: ENGR 200 or ENGR 198
Can be taken Concurrently: ENGR 200, ENGR 198

ENGR 160 Engineering Internship 1-3 Credits
Offers students who have attained at least Jr2 standing an opportunity to complement coursework with a work experience. Detailed rules can be obtained from the Associate Dean of Engineering. Report required. P/F grading.

ENGR 200 Engineering Work Experience 3 Credits
Supervised work assignment to obtain practical experience. Must have acceptance into the program. P/F grading.
Repeat Status: Course may be repeated.

ENGR 211 (BIOC 211, BIOE 211, MAT 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.

ENGR 212 (BIOC 212, BIOE 212, MAT 212, ME 212) Capstone Design Project II 2 Credits
Students continue developing their solutions from ME 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.

ENGR 300 Apprentice Teaching 1-3 Credits

ENGR 400 Experiential Learning for Engineering Graduate Students 1-3 Credits
Supervised work assignment outside of the university to obtain practical experience in field of study. Requires consent of department chairperson. When on an assignment, the student must register for this course to maintain continuous student status. Limit to at most three credits per registration period. No more than six credits may be applied towards a master's program and no more than nine credits may be used throughout a student's entire graduate study at Lehigh.
Repeat Status: Course may be repeated.

ENGR 401 Teaching/Presentation Skills 1 Credit
Development of teaching and presentation skills for scientific professionals. Presentation effectiveness, teaching/presentation methodologies, classroom management, course development/ content preparation, lecture/presentation development and lecture/ presentation delivery. Individualized undergraduate course specific modules selected by student. Enrollment limited to Rossin Doctoral Fellows.

ENGR 402 Preparing for the Professoriate 1 Credit
Overview of the job search, research program development and service skills for graduate students entering academic careers. Transition from graduate student to faculty responsibilities, the post-doctoral experience, time management, CV/resume preparation, faculty search process, tenure and promotion, research leadership and program development, research proposal preparation and research sponsorship. Enrollment limited to Rossin Doctoral Fellows.

ENGR 430 Technical Writing for Engineering and the Sciences 1 Credit
Formal composition and technical writing skills for advanced non-native English writers in Engineering and the Sciences. Instructor and peer review of writing, self-editing strategies, how to incorporate technical vocabulary and formulas, advanced sentence structure, and appropriate citation of research. Field-specific readings, which students must compile, critique, and model in their own writing. Designed for international graduate students who are writing or preparing to write publishable quality articles, theses, or dissertations.

ENGR 440 Intensive Teaching Workshop 0 Credits
Two-day intensive teaching workshop designed to prepare doctoral students for a teaching practicum experience. Various faculty will discuss a range of topics including fundamentals of effective teaching, motivating students, inclusive teaching, principles of teaching under a research perspective, explaining difficult topics, assessing student learning and enhancing learning with instructional technology. Students will be required to prepare and lead micro-teaching sessions. Course requires Dean's office permission and may not be repeated.

ENGR 441 Teaching Practicum 1-3 Credits
Mentored teaching experience focused on the design, organization, pedagogy and assessment of university courses in engineering. Students will work with a faculty member to develop teaching and communication skills and apply best practices in university teaching while receiving feedback. Specific course assignments will be determined by the student's home department and must be approved by the department chair. Course may be repeated for credit.
Repeat Status: Course may be repeated.
Prerequisites: ENGR 440

ENGR 452 (BIOE 452, CHE 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

ENGR 490 Thesis (Moc) 1 Credit

ENGR 492 (ARTS 492, BUS 492) Summer Research 1-3 Credits
Summer research experience designated for engineering graduate students at both the master's and doctoral level who are participating in full-time research during the entire summer semester. Students must have a summer research appointment to be eligible to enroll in this course. The course is repeatable, however, credits earned for this course cannot be used to fulfill degree requirements.
Repeat Status: Course may be repeated.

ENGR 499 Dissertation (Moc) 1 Credit

Industrial and Systems Engineering

Mission Statement

To pursue excellence and national prominence in the areas of manufacturing, operations research, information technology and related fields of industrial and systems engineering through innovative teaching, distinguished research and scholarship, and active professional leadership. Building on its unique strength and national reputation in undergraduate education and industrial research, the department strives for leadership in educational innovation, multidisciplinary research, and industrial partnership. Our ultimate mission is to produce leaders who have learned to think critically and analytically, have the skills and techniques to comprehend and create new knowledge, and are willing to serve and inspire others.

Physical Facilities

The industrial and systems engineering department is located in the Harold S. Mohler Laboratory at 200 West Packer Avenue at the northwest corner of the Lehigh University Asa Packer campus. The Mohler Lab building contains the classrooms, laboratories, and faculty offices of the department. Labs in the Mohler Laboratory building include:

Computational Optimization Research @ Lehigh (COR@L) Lab. The COR@L lab consists of high performance computer workstations, each equipped with state-of-the-art commercial and noncommercial software for large-scale numerical optimization. COR@L is used for both research and instruction.

Enterprise Systems Center Laboratories. The ESC Laboratories contain a variety of computer systems and software in support of agility in Computer Integrated Manufacturing (CIM) and in engineering logistics and distribution problem solving, including: Computer Aided Design (CAD), Computer Aided Engineering (CAE), discrete event simulation, linear and nonlinear optimization, Finite Element Analysis (FEA), facilities design, process design, process control, and analytics software, such as the SAS software suite.

Manufacturing Technology Laboratory (MTL). The MTL contains equipment for instruction and research in manufacturing processes, numerical control (NC), NC part programming, material handling and storage, industrial control systems, and metrology.

Automation and Robotics Laboratory. This lab is located in the MTL, it contains a variety of industrial robots and other automated systems to provide students with hands-on experience in the planning and use of this kind of equipment.

Work Systems Laboratory. This classroom/laboratory affords the opportunity for undergraduate students to analyze and plan human work activities for individual workstations and worker team situations. A full scale manual assembly line is available for study.

ISE Computer Laboratories. Considerable use is made of university computer facilities in ISE coursework. ISE/computing center PC laboratories containing 38 and 16 PCs, respectively, are located in the Mohler Laboratory building.

B.S. in Industrial & Systems Engineering

Industrial & Systems Engineering (ISE) is concerned with the analysis, design, and implementation of integrated systems of people, materials, information, and equipment to accomplish useful work.

Career Opportunities

ISE graduates are sought by nearly all industrial corporations as well as government agencies and other service institutions. Major employers of our graduates include management consulting firms, manufacturing companies, banks, hospitals, railroads, the postal service, and transportation/logistics services. A typical career path of an industrial and systems engineer is to start in an entry level engineering position or as a technical analyst and to progress through various management positions in the firm or institution. Significant numbers of industrial and systems engineers ultimately become chief executive officers, chief operating officers, and chief technology officers in their respective organizations.

Production Systems Career Opportunities

The discipline of industrial & systems engineering is applicable in nearly all industries, whether the industry involves manufacturing of a product or delivery of a service. Job functions performed by ISEs include: systems analysis, cost estimation, capital equipment selection, engineering economy, facilities planning, production planning and scheduling, inventory control, quality control, project management, operations management, engineering management, as well as methods analysis and work measurement. Manufacturing systems engineering (MSE) is a specialty field associated with industrial and systems engineering that emphasizes functions and technologies such as process planning, plant layout design, manufacturing resource planning, production management, production line design, automation, robotics, flexible manufacturing systems, and computer integrated manufacturing.

Information Systems Career Opportunities

The Industrial & Systems Engineering program can also produce graduates who understand the complex facets of modern information systems, and the integration of these systems in industrial, service and financial organizations. The ISE student has an opportunity to focus on three important areas that are key to a successful information systems-oriented career. (1) Information Economics, (2) Quantitative Systems Analysis, and (3) Information Technology. These areas are coupled with general engineering and business background courses. Information economics studies the formulation, structure, and operational dynamics of information-centric systems in the context of industrial organizations, service sector economics, and financial institutions. Quantitative systems analysis studies operations research and computational tools for analyzing complex systems and their information components. Information technology and applications studies computer and communication technologies needed to design and implement information system applications. Topic areas include the applications of information technology in manufacturing and business environments, including electronic commerce, supply chain and enterprise information systems, manufacturing information systems, and financial enterprises.

ISE Curriculum

The ISE curriculum is designed to provide graduates with the skills and knowledge that employers expect of young industrial and systems engineers beginning their professional careers, and to instill the ability for lifetime learning. It includes the basic mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design that are specific to industrial and systems engineering. These principles and methods include probability and statistics, engineering economy, cost accounting, operations research, computer simulation, work methods and measurement, manufacturing processes, production and inventory control, and information technology.

In the junior year, an ISE student may elect to specialize more in production systems by choosing a course in modern manufacturing methods. Alternatively, a student may elect to specialize more in information systems by choosing a course in computer algorithm design. An ISE student must choose at least one of these courses, but may elect to choose both for a broader preparation for a career.

Specialized ISE electives in the senior year include: advanced optimization models, stochastic models, operations research, operations management, organization planning and control, statistical quality control, database design, web technologies, and data communications technologies. Electives related to manufacturing systems engineering include: industrial robotics, facilities planning and material handling, logistics and supply chain, and production engineering.

Program Educational Objectives

The set of key, over-arching objectives of the Industrial and Systems Engineering program are to prepare our students, within the first several years of the beginning of their careers, to

1. meet the expectations of employers of industrial and systems engineers,
2. pursue advanced study, if desired,
3. be active leaders in their profession and/or community.

Specifically, these general objectives can be met by graduates that

1. recognize and analyze problems, design innovative solutions, and lead their implementation,
2. excel as industrial and systems engineering professionals who are able to operate effectively in a global, culturally diverse society,
3. communicate effectively using written, oral, and electronic media,
4. pursue life-long learning and professional growth as ethical and responsible members of society,
5. form, lead, and participate on multi-disciplinary teams that solve problems in engineering and business.

In each course in the Industrial & Systems Engineering program, a subset of the student outcomes, listed below, are pursued to prepare students to achieve the Industrial and Systems Engineering program's stated objectives. This list of student outcomes articulated by the Engineering Accreditation Commission of ABET, http://www.abet.org , have been adopted by the program and are as follows:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively with a range of audiences

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

ISE Major Requirements

The ISE degree requires a minimum of 130 credit hours.

See freshman year requirements on the First Year Courses for Engineering Degrees under the heading of the P.C. Rossin College of Engineering and Applied Science (p. 400) An HSS course is

assumed to be taken in the freshman year in the following semester course plans.

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Sophomore

Fall	Credits	Spring	Credits
ISE 111	3	ISE 121	3
ISE 112	1	MATH 205	3
ISE 131	3	MAT 033 or CSE 004	2-3
ISE 132	1	PHY 021	0-4
MATH 023	4	PHY 022	1
Engineering Elective[3]	3	ECO 001 or HSS Elective[1]	3-4
CSE 003	2		
	17		**12-18**

Junior

Fall	Credits	Spring	Credits	Summer	Credits
ISE 230 or 240	3	ISE 240 or 230	3	ISE 100	0
ISE 224	3	ISE 226	3		
HSS Electives[1]	6-8	HSS Elective[1]	3-4		
Engineering Elective[3]	3	ISE 308 or 305	3		
		Select one of the following	4		
		ISE 172			
		ISE 215 & ISE 216			
	15-17		**16-17**		**0**

Senior

Fall	Credits	Spring	Credits
ISE 251	3	ISE Technical Electives[2]	6
ISE Technical Electives[2]	6	Free Electives	6
Free Elective	3	ISE 254[4]	3
HSS Elective[1]	3-4	ACCT 108	3
	15-16		**18**

Total Credits: 93-103

Notes:

1

HSS elective credit totals must satisfy the college HSS program requirements.

2

ISE Technical Electives include all ISE 300-level courses (except ISE 308 (formerly 305, which is required), ISE 260, the CSE 2XX (except CSE 241 and CSE 252) and 3XX courses, the BIS 3XX courses, and MATH 230. In addition, ISE 215 can be used as a technical elective, if ISE 172 is selected as a core course. Conversely, if ISE 215 and ISE 216 are selected as core courses, ISE 172 can be used as a technical elective. ISE 256 can be used as a technical elective . Of the 4 ISE technical electives that must be taken, at least 2 must be ISE courses.

3

Engineering Elective Course Candidates: Courses of 3 or more credits with course prefixes of BIOE, CHE, CEE, CSE, ECE, MAT, ME, or MECH for which the prerequisites are met. The courses with these prefixes that are excluded from consideration are listed on the following ISE Dept. web page: https://ise.lehigh.edu/content/courses (https://ise.lehigh.edu/content/courses/). The list of excluded courses for an individual ISE major is governed by the catalog in force when admitted to Lehigh. A provisional course offered with one of these prefixes requires departmental approval. Any course meeting these stipulations is denoted “Engineering Elective Requirement” in the ISE program description. A course counts toward meeting only one course requirements category for the ISE program.

4

The senior project course, ISE 254, requires senior standing and can be taken in either the fall or spring semester of the senior year.

5

CSE 007 can be used to replace CSE 003 and CSE 004.

Special Opportunities for ISE students

The following special opportunities are available to majors in industrial and systems engineering:

Nontechnical Minor. Students may choose to pursue a nontechnical minor in an area of the humanities, social sciences, business, or entrepreneurship. Students in the business minor can satisfy the ACCT 108 requirement by completing BUS 127.

Technical Minor. Technical minors such as engineering leadership, materials science, environmental engineering, and computer science are available through departments in the P. C. Rossin College of Engineering and Applied Science. Consult the specific department for more details.

Graduate Courses. Seniors in industrial and systems engineering can petition to take up to two graduate ISE courses (400-level) to satisfy two of their four 300-level elective ISE course requirements. The petitioning senior must have a good scholastic record (generally above a 3.0 GPA).

Senior Thesis Option. Students interested in continuing on to graduate school or performing research are encouraged to take the senior thesis option. In this option a student takes ISE 255 as a free elective to develop the thesis proposal. ISE 255 serves as a prerequisite to ISE 256 in which the thesis is written. ISE 256 may be used as an ISE technical elective.

Technical Minor in Engineering Leadership

The minor in engineering leadership provides students with the background and practice to become more effective leaders. The minor consists of 5 courses that explore different aspects of leadership. Additional details can be found on the Engineering Leadership Minor website (http://lehigh.edu/~inleader/).

Technical Minor in Manufacturing Systems Engineering

The minor in manufacturing systems engineering provides a concentration of courses in the manufacturing and production areas. This minor is not available to students majoring in industrial and systems engineering. It requires 16 credits.

Graduate Programs

The Department of Industrial and Systems Engineering (ISE) offers a Ph.D. degree and a variety of master's degrees that are designed to provide students the knowledge and skills to excel in careers that span industry and academia. The requirements of each program give students flexibility to personalize their program and take advantage of ISE’s world-recognized expertise in optimization, applied operations research, statistical modeling and machine learning, data science, quantum computing, and uncertainty quantification.

Additional information on all of our graduate programs can be found below.

M.S. in Industrial and Systems Engineering

The minimum program for the master of science degree in Industrial and Systems Engineering consists of 24 credit hours of approved coursework and completion of a satisfactory thesis. Courses in other departments for which the student has the prerequisites may be integrated into this program. Subject to advisor approval, up to nine credit hours of 300 and 400-level courses from other departments may be included in the Industrial and Systems Engineering masters program. The other department courses usually include other engineering disciplines, mathematics, computer science, and business and economics.

M.Eng. in Industrial and Systems Engineering

This program of study is for those students whose interests are toward engineering design rather than research. The program provides opportunity to gain greater breadth of field through 30 credit hours of coursework (which can include a 3-credit-hour project).

M.S. in Management Science and Engineering

See separate catalog listing under Management Science and Engineering (p. 472).

M.Eng. in Management Science and Engineering

See separate catalog listing under Management Science and Engineering (p. 472).

M.S. in Optimization (OPT)

The Master of Science (M.S.) degree in Optimization is primarily designed to meet the goals and interests of students whose professional plans include research in an educational, governmental, or industrial environment. Students graduating from the program will have a solid understanding of how to design, analyze, implement, and use optimization algorithms for solving problems arising throughout engineering and data science.

Each student is required to take 12 credit hours of graduate coursework in the area of Optimization, as well as supplement this specific knowledge with broader knowledge obtained by taking 9 additional credit hours of coursework in the Department of Industrial and Systems Engineering (ISE). The student rounds out their degree by taking 9 additional credit hours of relevant coursework from any department at Lehigh University. All coursework must be approved by the ISE Master Program Director. The above total of 30-credit hours of coursework may include project-based courses as well as a masters thesis.

M.S. in Industrial Engineering and Operations Research (IEOR)

The Master of Science (M.S.) degree in Industrial Engineering and Operations Research provides engineering graduates the skills and knowledge to pursue careers in their field of interest while meeting the industrial engineering needs of industry, business, health, and government. Graduates will be motivated to continue learning throughout their career, and gain the knowledge and skills to contribute significantly to society. Students graduating from the program will have great knowledge of, and practice in using, a multitude of tools used throughout industrial engineering and operations research.

Each student is required to take 12-credit hours of graduate coursework in the area of Industrial Engineering and Operations Research, as well as supplement this knowledge with additional broader knowledge obtained by taking 9 additional credit hours of coursework in the Department of Industrial and Systems Engineering (ISE). The student rounds out their degree by taking 9 additional credit hours of relevant coursework from any department at Lehigh University. All coursework must be approved by the ISE Master Program Director. The above total of 30-credit hours of coursework may include project-based courses as well as a masters thesis.

M.S. in Health Systems Engineering

The Master of Science (M.S.) degree in Health Systems Engineering (HSE) produces graduates with strong fundamental skills in industrial and systems engineering and a strong background in health systems and processes. Graduates will be ideally positioned for skilled professional management roles aimed at improving quality, streamlining processes and improving efficiency in health systems. This degree program is designed to prepare graduate students for engineering and management careers in firms engaged in delivering health-related products and services.

Students seeking to enroll to the program should have a bachelor's degree in engineering, mathematics, science, or business. Students should be quantitatively oriented and have completed a calculus based probability and statistics course. A candidate lacking certain background may be required to take background courses.

The program consists of 30 credit hours of course work that may be completed either in-person or online.

Each student is required to take 9-credit hours of graduate coursework in the area of health and an additional 9-credit hours of graduate coursework in the Department of Industrial and Systems Engineering (ISE). The student rounds out their degree by taking 6 additional credit hours of relevant coursework from the College of Engineering and 6 additional credits hours of relevant coursework from any department at Lehigh University. All coursework must be approved by the HSE Master Program Director. The above total of 30 credit hours of coursework may include project-based courses as well as a masters thesis.

M.S. in Financial Engineering

The Masters in Financial Engineering program combines key concepts in financial theory, mathematical finance and engineering decision making to produce professionals instrumental in creating innovative solutions to real financial issues. See separate catalog listing under Interdisciplinary Graduate Study and Research (p. 507).

Ph.D. in Industrial and Systems Engineering

The graduate program leading to the doctor of philosophy (Ph.D.) degree is organized to meet the individual goals and interests of graduate students whose professional plans include teaching, consulting, or research in an educational, governmental, or industrial environment. Each doctoral candidate is required to demonstrate: (1) a high level of proficiency in one or more fields of industrial and systems engineering, and (2) a capacity for independent research through the preparation of a dissertation related to his/her field of specialization.

The research directions of the program include mathematical optimization, data science and machine learning, energy and service systems, and high-performance computing. Methodological research thrusts focus on optimization, machine learning, stochastics, and quantum computing. On the applied side, the expertise of our faculty revolves around the operations and analytics of energy, finance, healthcare, mobility & transportation, and supply chain management.

The Lehigh ISE Ph.D. program offers a vibrant perspective on the next generation of data science, providing students with the knowledge base and research skills that are necessary to mine and analyze high-volume data using state-of-the-art optimization and stochastic modeling techniques.

Students in our program have the opportunity to take a variety of courses covering the spectrum of descriptive, diagnostic, predictive, and prescriptive analytics, in topics such as:

- Convex Analysis & Mathematical Optimization
- Stochastic Models & Statistical Learning
- Continuous & Discrete Optimization
- Optimization Methods in Machine Learning
- Machine Learning & Data Mining
- Reinforcement Learning & Dynamic Programming

A summary of the requirements to obtain the Ph.D. degree offered by Lehigh ISE is the following. Further details, along with rules and procedures particular to the program, can be found on the Department of ISE website.

- Program Requirements. (These requirements remain incomplete until a student passes the Program Review, which in turn cannot be passed until all other Program Requirements have been completed.)

- Complete a set of core and elective (i.e., non-core) Ph.D.-level courses.
- Acquire an advisor from among the program faculty members.
- Pass a Qualifying Examination conducted by a committee of program faculty members.
- Pass a Performance Review conducted by the program faculty members.
- Pass a Program Review conducted by the ISE Director of Graduate Studies (DGS) (or, conditionally, the program faculty members).

- Doctoral Research Requirements. (These requirements remain incomplete until a student passes the Dissertation Defense, which in turn cannot be passed until all other Doctoral Research Requirements have been completed and the student submits a dissertation approved by all of the student's doctoral committee members to the RCEAS.)
  - Form a doctoral committee satisfying the RCEAS requirements.
  - Pass a Dissertation Proposal Defense conducted by the doctoral committee.
  - Receive Admission to Candidacy for the Doctorate by the RCEAS.
  - Complete paperwork to indicate passage of the General Examination required by the RCEAS.
  - Accumulate a number of credits as required by the RCEAS.
  - Pass a Dissertation Defense conducted by the doctoral committee.
- Additional Requirements.
  - Submit annual progress reports to the ISE DGS.
  - Any additional Ph.D. degree requirements specified by the RCEAS and Lehigh.

Courses

ISE 100 Industrial Employment 0 Credits
Usually following the junior year, students in the industrial engineering curriculum are required to do a minimum of eight weeks of practical work, preferably in the field they plan to follow after graduation. A report is required. Must have sophomore standing.

ISE 111 Engineering Probability 3 Credits
Random variables, probability models and distributions. Poisson processes. Expected values and variance. Joint distributions, covariance and correlation.
Prerequisites: MATH 022 or MATH 096 or MATH 032 or MATH 052

ISE 112 Computer Graphics 1 Credit
Introduction to interactive graphics and construction of multiview representations in two and three dimensional space. Applications in industrial engineering. Must have sophomore standing in industrial engineering.

ISE 121 Applied Engineering Statistics 3 Credits
The application of statistical techniques to solve industrial problems. Regression and correlation, analysis of variance, quality control, and reliability.
Prerequisites: ISE 111 or MATH 231 or IE 111

ISE 131 Work Systems and Operations Management 3 Credits
Workermachine systems, work flow, assembly lines, logistics and service operations, and project management. Operations analysis, methods engineering, work measurement, lean production, and six sigma. Workplace ergonomics, plant layout design, and work management.
Prerequisites: ISE 111 or MATH 231 or IE 111
Can be taken Concurrently: ISE 111, MATH 231, IE 111

ISE 132 Work Systems Laboratory 1 Credit
Laboratory exercises, case studies, and projects in operations analysis, methods engineering, work measurement, and plant layout design.
Prerequisites: ISE 131 or IE 131
Can be taken Concurrently: ISE 131, IE 131

ISE 172 Algorithms in Systems Engineering 0,4 Credits
Use of computers to solve problems arising in systems engineering. Design and implementation of algorithms for systems modeling, systems design, systems analysis, and systems optimization. Computer systems, basic data structures, the design and implementation of efficient algorithms, and application of algorithms to the design and optimization of complex systems such as those arising in transportation, telecommunications, and manufacturing. Weekly laboratory with exercises and projects.
Prerequisites: CSE 004 or CSE 007 or CSE 017

ISE 215 Fundamentals of Modern Manufacturing 3 Credits
Manufacturing processes and systems. Metal machining and forming, polymer shape processes, powder metallurgy, assembly and electronics manufacturing. Introduction to automation, numerical control, and industrial robots.
Prerequisites: MAT 033

ISE 216 Manufacturing Laboratory 1 Credit
Laboratory exercises and experiments in manufacturing processes and systems.
Prerequisites: ISE 215 or IE 215
Can be taken Concurrently: ISE 215, IE 215

ISE 224 Information Systems Analysis and Design 3 Credits
An introduction to the technological as well as methodological aspects of computer information systems. Content of the course stresses basic knowledge in database systems. Database design and evaluation, query languages and software implementation. Students that take CSE 241 cannot receive credit for this course.

ISE 226 Engineering Economy and Decision Analysis 3 Credits
Economic analysis of engineering projects; interest rate factors, methods of evaluation, depreciation, replacement, breakeven analysis, aftertax analysis. decision-making under certainty and risk.
Prerequisites: ISE 111 or MATH 231 or IE 111
Can be taken Concurrently: ISE 111, MATH 231, IE 111

ISE 230 Introduction to Stochastic Models in Operations Research 3 Credits
Formulating, analyzing, and solving mathematical models of real-world problems in systems exhibiting stochastic (random) behavior. Discrete and continuous Markov chains, queueing theory, inventory control, Markov decision process. Applications typically include traffic flow, call centers, communication networks, service systems, and supply chains.
Prerequisites: ISE 111 or IE 111 or MATH 231

ISE 240 Introduction to Deterministic Optimization Models in Operations Research 3 Credits
Formulating, analyzing, and solving mathematical models of real-world problems in systems design and operations. A focus on deterministic optimization models having parameters that are known and fixed. Algorithmic approaches for linear, integer, and nonlinear problems. Solving optimization problems utilizing specialized software.
Prerequisites: MATH 205

ISE 251 Production and Inventory Control 3 Credits
Techniques used in the planning and control of production and inventory systems. Forecasting, inventory models, operations planning, and scheduling.
Prerequisites: ISE 121 and ISE 230 and ISE 240
Can be taken Concurrently: ISE 230, ISE 240

ISE 254 Senior Project 0,3 Credits
The use of industrial and systems engineering techniques to solve a major problem in either a manufacturing or service environment. Problems are sufficiently broad to require the design of a system. Human factors are considered in system design. Laboratory component provides significant industry exposure.
Prerequisites: ISE 226 or ISE 251
Can be taken Concurrently: ISE 226, ISE 251

ISE 255 Senior Thesis I 3 Credits
In-depth study of a research topic in industrial and systems engineering supervised by an Industrial and Systems Engineering department faculty member. Requires completion of a formal research proposal and a public presentation of the proposal at the end of the semester.

ISE 256 Senior Thesis II 3 Credits
Continued in-depth study of a research topic in industrial and systems engineering supervised by an Industrial and Systems Engineering department faculty member. Requires a formal thesis and public presentation of the results.
Prerequisites: ISE 255

ISE 260 (WGSS 260) Algorithms and Social Justice 4 Credits
This course explores how algorithms reflect and magnify social inequality. Topics include race, gender, sexuality, and class in the context of policing and punishment, search engines and social media, and ranking and optimization. Readings, discussions, and assignments are designed to cultivate transdisciplinary competence in the history of science and technology, feminist theory, machine learning, and artificial intelligence, and to encourage peer-to-peer learning across the humanities, social science, and engineering.

ISE 275 Fundamentals of Web Applications 3 Credits
Introduction to web technologies required to support the development of client side and server side components of Internet based applications. Students will be exposed to the problems of design, implementation, and management by way of assigned readings, class discussion, and project implementation. Term project.
Prerequisites: ISE 224 or IE 224 or CSE 241
Can be taken Concurrently: ISE 224, IE 224, CSE 241

ISE 281 Leadership Project 1-3 Credits
Application of leadership principles through team projects with industry. Written report required.
Repeat Status: Course may be repeated.
Prerequisites: ISE 382 or IE 382

ISE 300 Apprentice Teaching 1-4 Credits

ISE 304 Introduction to Mathematics and Statistics for Industrial Engineering 3 Credits
Random variables, probability functions, expected values, statistical inference, hypothesis testing, regression and correlation, analysis of variance, and introduction to design of experiments. Review of linear algebra and an introduction to quantitative analysis, matrices, concepts associated with systems of linear equations and linear optimization, algebraic and geometric models. Credits for this course cannot be applied to any undergraduate degree offered by the Industrial and Systems Engineering (ISE) Department. Consent of department required.
Prerequisites: MATH 023

ISE 308 Simulation 3 Credits
Applications of discrete and continuous simulation techniques in modeling industrial systems. Simulation using a high-level simulation language. Design of simulation experiments. This course is an undergraduate version of ISE 408. A student can receive credit for only one of the following courses: ISE 305, ISE 404, ISE 308, and ISE 408.
Prerequisites: ISE 121

ISE 309 Time Series Analysis 3 Credits
Theory and applications of an approach to process modeling, analysis, prediction, and control based on an ordered sequence of observed data. Single or multiple time series are used to obtain scalar or vector difference/ differential equations describing a variety of physical and economic systems. This course is an undergraduate version of ISE 409. A student cannot receive credit for both ISE 309 and ISE 409.

ISE 310 Design of Experiments 3 Credits
Experimental procedures for sorting out important causal variables, finding optimum conditions, continuously improving processes, and trouble shooting. Applications to laboratory, pilot plant and factory. Must have some statistical background and experimentation in prospect. This course is an undergraduate version of ISE 410. A student cannot receive credit for both ISE 310 and ISE 410.
Prerequisites: ISE 121

ISE 321 Independent Study in Industrial and Systems Engineering 1-3 Credits
Experimental projects in selected fields of industrial engineering, approved by the instructor. A written report is required. Department permission required.
Repeat Status: Course may be repeated.

ISE 324 Industrial Automation and Robotics 3 Credits
Introduction to robotics technology and applications. Robot anatomy, controls, programming, work cell design, sensors, vision systems, using Programmable Logic Controllers. Laboratory exercises. This course is an undergraduate version of ISE 424. A student cannot receive credit for both ISE 324 and ISE 424.
Prerequisites: MATH 205

ISE 327 Facilities Planning and Material Handling 3 Credits
Facilities planning including plant layout design and facility location. Material handling analysis including transport systems, storage systems, and automatic identification and data capture. This course is an undergraduate version of ISE 427. A student can receive credit for only one of the following courses: ISE 319, ISE 327, and ISE 427.
Prerequisites: ISE 131

ISE 332 Product Quality 3 Credits
Introduction to engineering methods for monitoring, control, and improvement of quality. Statistical models of quality measurements, statistical process control, acceptance sampling, and quality management principles. Some laboratory exercises. This course is an undergraduate version of ISE 432. A student cannot receive credit for both ISE 332 and ISE 432.
Prerequisites: ISE 121

ISE 333 Introduction to Systems Engineering and Decision Analysis 3 Credits
Systems Engineering modeling techniques. Architectures for large scale systems design. Includes physical, functional, and operational architectures. Requirements engineering, interface and integration issues, graphical modeling techniques. Additional topics may include: decision analysis techniques for systems, uncertainty analysis, utility functions, multiattribute utility functions and analysis, influence diagrams, risk preference, Analytical Hierarchy and Node Processes in decision making. A student cannot receive credit for both ISE 333 and ISE 356.
Prerequisites: ISE 230 and ISE 240

ISE 334 Operational Excellence 3 Credits
Provides a comprehensive understanding of Operational Excellence within an organization. From defining business strategy and creating measurable initiatives and metrics, students learn various tools, such as Lean and Six Sigma Methodologies, Sales, Operations and Inventory Planning, and Change, and Project Management to optimize the end-to-end value chain. These tools enhance operational and organizational efficiency in complex business environments. This course is an undergraduate version of ISE 434. A student cannot receive credit for both ISE 334 and ISE 434.

ISE 335 Planning and Scheduling in Manufacturing and Services 3 Credits
Models for the planning and scheduling of systems that produce goods or services. Resource allocation techniques utilizing static and dynamic scheduling methods and algorithms. Application areas include manufacturing and assembly systems, transportation system timetabling, project management, supply chains, and workforce scheduling. This course is an undergraduate version of ISE 435. A student can receive credit for only one of the following courses: ISE 335, ISE 435, and ISE 419.

ISE 336 Engineering Project Management 3 Credits
Presents the principles and techniques used in all phases of managing engineering projects that includes the initial phase, planning, execution, control, and closeout. Students develop the analytical skills and awareness necessary for managing engineering projects.

ISE 339 Stochastic Models and Applications 3 Credits
Introduction to stochastic process modeling and analysis techniques and applications. Generalizations of the Poisson process; renewal theory and applications to inventory theory, queuing, and reliability; Brownian motion and stationary processes. This course is an undergraduate version of ISE 439. A student cannot receive credit for both ISE 339 and ISE 439.
Prerequisites: ISE 230

ISE 347 Financial Optimization 3 Credits
Making optimal financial decisions under uncertainty. Financial topics include asset/liability management, option pricing and hedging, risk management and portfolio optimization. Optimization covered includes linear/nonlinear optimization, discrete optimization, dynamic programming and stochastic optimization. Emphasis on use of modeling languages and solvers in financial applications. Requires basic knowledge of linear optimization and probability. This course is an undergraduate version of ISE 447. A student cannot receive credit for both ISE 347 and ISE 447.
Prerequisites: ISE 240

ISE 355 Optimization Algorithms and Software 3 Credits
Basic concepts of large families of optimization algorithms for both continuous and discrete optimization problems. Pros and cons of the various algorithms when applied to specific types of problems; information needed; whether local or global optimality can be expected. Participants practice with corresponding software tools to gain hands-on experience. This course is an undergraduate version of ISE 455. A student cannot receive credit for both ISE 355 and ISE 455.
Prerequisites: ISE 240

ISE 358 Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations. Applications include strategic pricing, negotiations, voting, contracts and economic incentives, and environmental issues. This course is an undergraduate version of ISE 458. A student cannot receive credit for both ISE 358 and ISE 458.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076

ISE 362 (MSE 362) Logistics and Supply Chain Management 3 Credits
Modeling and analysis of supply chain design, operations, and management. Analytical framework for logistics and supply chains, demand and supply planning, inventory control and warehouse management, transportation, logistics network design, supply chain coordination, and financial factors. Students complete case studies and a comprehensive final project. This course is an undergraduate version of ISE 462. A student cannot receive credit for both ISE 362 and ISE 462.
Prerequisites: ISE 230 and ISE 240

ISE 364 Introduction to Machine Learning 3 Credits
Techniques of applied machine learning rather than deep theory behind the algorithms and methods. Programming solutions for machine learning problems using a high-level programming language and associated machine learning libraries. Regression, clustering, principal component analysis, Bayesian methods, decision trees, random forests, support vector machines, and neural networks. This course is an undergraduate version of ISE 464. A student cannot receive credit for both ISE 364 and ISE 464.
Prerequisites: CSE 003 or CSE 007 or CSE 017

ISE 365 Applied Data Mining 3 Credits
Introduction to the data mining process including business problem understanding, data understanding and preparation, modeling and evaluation, and model deployment. Emphasis on hands-on data preparation and modeling using techniques from statistics, artificial intelligence, such as regression, decision trees, neural networks, and clustering. A number of application areas are explored. This course is an undergraduate version of ISE 465. A student cannot receive credit for both ISE 365 and ISE 465.
Prerequisites: ISE 121 or ISE 304

ISE 371 Quality and Process Improvement in Healthcare 3 Credits
The dimensions of Healthcare quality and their definitions, quality metrics, accreditation and other benchmarking and evaluation methods. Change management, project planning and team management. Continuous improvement tools including “lean”, “six-sigma”, and “TQM”. This course is an undergraduate version of ISE 471. A student cannot receive credit for both ISE 371 and ISE 471.

ISE 372 Financial Management in Healthcare 3 Credits
Engineering economics in Healthcare; value metrics (net present value, return on investment, etc.), cost-benefit analysis, capital projects and improvements. Accounting methods in Healthcare systems. Reimbursement methods, organizations, and alternatives. Financial strategy, planning, pricing and capital formation in “for”, and “not for” profit settings. This course is an undergraduate version of the graduate level course ISE 472. A student cannot receive credit for both ISE 372 and ISE 472.
Prerequisites: ((ISE 220 or IE 220) or ((ISE 230 or IE 230) and (ISE 240 or IE 240),),) and (ISE 275 or IE 275)

ISE 382 Leadership Development 3 Credits
Exploration and critical analysis of theories, principles, and processes of effective leadership. Managing diverse teams, communication, and ethics associated with leadership. Application of knowledge to personal and professional life through projects and team assignments. This course is an undergraduate version of ISE 482. A student cannot receive credit for both ISE 382 and ISE 482.

ISE 401 Convex Analysis 3 Credits
Theory and applications of convex analysis, particularly as it relates to convex optimization and duality theory. Content of the course emphasizes rigorous mathematical analysis as well as geometric and visually intuitive viewpoints of convex objects and optimization problems.

ISE 402 Operations Research Models and Applications 3 Credits
Applied models in operations research, including models in supply chain management, energy, health care, disaster relief, and/or financial optimization. Models, theorems, algorithms, and skills for translating practical problems into mathematical ones.

ISE 403 Research Methods 3 Credits
Skills for conducting doctoral research. Topics include technical reading, technical writing, computing skills, literature review skills, and research ethics.

ISE 406 Fundamentals of Optimization 3 Credits
Introduction to theory and algorithms for linear, discrete, and convex mathematical optimization. Significant portion dedicated to linear optimization theory from both geometric and algebraic perspectives. Basic coverage of discrete optimization, including modeling techniques and algorithmic ideas for solving discrete optimization problems such as branch-and-bound and cutting planes. Basic introduction to convex optimization, including convex sets and functions, duality theory, and optimality conditions.

ISE 407 Numerical Methods and Scientific Computing 3 Credits
Topics in numerical methods, numerical analysis, and scientific computing including floating point arithmetic, conditioning and stability, data structures for scientific computing, analysis of algorithms, and direct and iterative methods for numerical linear algebra. Emphasis on efficient implementations in modern computing languages.

ISE 408 Simulation 3 Credits
Applications of discrete and continuous simulation techniques in modeling industrial systems. Simulation using a highlevel simulation language. Design of simulation experiments. This course is a version of ISE 308 for graduate students, with advanced assignments. A student can receive credit for only one of the following courses: ISE 305, ISE 404, ISE 308, and ISE 408.

ISE 409 Time Series Analysis 3 Credits
Theory and applications of an approach to process modeling, analysis, prediction, and control based on an ordered sequence of observed data. Single or multiple time series are used to obtain scalar or vector difference/ differential equations describing a variety of physical and economic systems. This course is a version of ISE 309 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 309 and ISE 409.

ISE 410 Design of Experiments 3 Credits
Experimental procedures for sorting out important causal variables, finding optimum conditions, continuously improving processes, and trouble shooting. Applications to laboratory, pilot plant and factory. Must have some statistical background and experimentation in prospect. This course is a version of ISE 310 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 310 and ISE 410.

ISE 411 Networks and Graphs 3 Credits
This course examines the theory and applications of networks and graphs. Content of the courses stresses the modeling, analysis and computational issues of network and graph algorithms. Complexity theory, trees and arborescences, path algorithms, network flows, matching and assignment, primal-dual algorithms, Eulerian and Hamiltonian walks and various applications of network models.

ISE 412 Quantitative Models of Supply Chain Management 3 Credits
Analytical models for logistics and supply chain coordination. Modeling, analysis, and computational issues of production, transportation, and other planning and decision models. Logistics network configuration, risk pooling, stochastic decision-making, information propagation, supply chain contracting, and electronic commerce implication.
Prerequisites: ISE 316 or ISE 426

ISE 414 Uncertainty Quantification 3 Credits
In-depth exploration of the principles, methodologies, and practical applications of managing uncertainty in the context of optimization, operations research, data science, and scientific computing.
Prerequisites: ISE 403 and ISE 429

ISE 415 Optimization Under Uncertainty 3 Credits
Modeling, theory, solution algorithms, and applications of optimization models under uncertainty. Topics include stochastic, robust, and distributionally robust optimization techniques, including the mathematics of obtaining their associated deterministic equivalent optimization problems.

ISE 416 Dynamic Programming 3 Credits
This course is concerned with the dynamic programming approach to sequential decision making under uncertainty, exact solution algorithms, and approximate methods adapted to large-scale problems. Value iteration, policy iteration and lambda-policy iteration are introduced and analyzed using fixed-point theory. The linear optimization approach to dynamic programming is introduced. Special policy structures are studied. Algorithms based on sampling and on the use of linear approximation architectures are covered.
Prerequisites: ISE 316 or IE 316

ISE 417 Continuous Optimization 3 Credits
Theoretical principles underlying continuous (nonlinear) optimization problems and the numerical methods that are available to solve them. Topics include the steepest descent method, Newton's method for unconstrained optimization, necessary and sufficient optimality conditions, duality, line search and trust region methods for unconstrained optimization, derivative-free and quasi-Newton techniques, and other numerical methods relevant for solving continuous optimization problems.

ISE 418 Discrete Optimization 3 Credits
Theory, algorithms, and applications of discrete optimization. Focus on mathematical and algorithmic foundations with emphasis on techniques most successful in current software implementations, such as convexification and enumeration. Use of commercial and open source software and frameworks for solving discrete optimization problems will be discussed.

ISE 422 Quantum Computing Optimization 3 Credits
Quantum computers have the potential to efficiently solve optimization problems that are intractable for classical computers. Foundations and basic concepts of quantum computing are discussed. Sample list of topics include: quantum mechanics of qubits; quantum entanglement; quantum circuits, quantum Fourier transform; the Shor factorization algorithm; the Grover search algorithm; elements of quantum linear algebra and quantum tomography; Quantum approximate optimization algorithm and quantum interior point methods.

ISE 424 Industrial Automation and Robotics 3 Credits
Introduction to robotics technology and applications. Robot anatomy, controls, programming, work cell design, sensors, vision systems, using Programmable Logic Controllers. Laboratory exercises. This course is a version of ISE 324 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 324 and ISE 424.

ISE 426 Optimization Models and Applications 3 Credits
Modeling and analysis of operations research problems using techniques from mathematical programming. Linear programming, integer programming, multicriteria optimization, stochastic programming and nonlinear programming using an algebraic modeling language. A student can receive credit for only one of the following courses: ISE 240, ISE 316, and ISE 426.

ISE 427 Facilities Planning and Material Handling 3 Credits
Facilities planning including plant layout design and facility location. Material handling analysis including transport systems, storage systems, and automatic identification and data capture. This course is a version of ISE 327 for graduate students, with advanced assignments. A student can receive credit for only one of the following courses: ISE 316, ISE 327, and ISE 427.

ISE 429 Probability and Stochastic Processes 3 Credits
Mathematical foundations of probability and stochastic processes for modeling and analyzing real-world phenomena. Modeling and analyzing systems that evolve over time, such as queueing systems. Topics include probabilistic models, fundamental theorems of probability, conditional probability, independence, random variables, distribution functions, laws of large numbers, martingales, Markov chains, Poisson processes, and Brownian motion.

ISE 432 Product Quality 3 Credits
Introduction to engineering methods for monitoring, control, and improvement of quality. Statistical models of quality measurements, statistical process control, acceptance sampling, and quality management principles. Some laboratory exercises. This course is a version of ISE 332 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 332 and ISE 432.

ISE 434 Operational Excellence 3 Credits
Provides a comprehensive understanding of Operational Excellence within an organization. From defining business strategy and creating measurable initiatives/metrics, students learn tools, such as Lean and Six Sigma Methodologies, Sales, Operations and Inventory Planning, and Change, and Project Management to optimize the end-to-end value chain. These tools enhance operational and organizational efficiency in complex businesses. This course is a version of ISE 334 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 334 and ISE 434.

ISE 435 Planning and Scheduling in Manufacturing and Services 3 Credits
Models for the planning and scheduling of systems that produce goods or services. Resource allocation techniques utilizing static and dynamic scheduling methods and algorithms. Application areas include manufacturing and assembly systems, transportation system timetabling, project management, supply chains, and workforce scheduling. This course is a version of ISE 335 for graduate students, with advanced assignments. A student can receive credit for only one of the following courses: ISE 335, ISE 419, and ISE 435.

ISE 436 Engineering Project Management 3 Credits
Presents the principles and techniques used in all phases of managing engineering projects that includes the initial phase, planning, execution, control, and closeout. Students develop the analytical skills and awareness necessary for managing engineering projects. This course is a version of ISE 336 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 336 and ISE 436.
Repeat Status: Course may be repeated.

ISE 439 Stochastic Models and Applications 3 Credits
Introduction to stochastic process modeling and analysis techniques and applications. Generalizations of the Poisson process; renewal theory and applications to inventory theory, queuing, and reliability; Brownian motion and stationary processes. This course is a graduate version of ISE 339. A student cannot receive credit for both ISE 339 and ISE 439.

ISE 441 Financial Engineering Projects 3 Credits
Analysis, design and implementation of solutions to problems in financial services using information technology, mathematical modeling, and other financial engineering techniques. Emphasis on realworld problem solving, problem definition, implementation and solution evaluation.

ISE 443 (MSE 443) Automation and Production Systems 3 Credits
Principles and analysis of manual and automated production systems for discrete parts and products. Cellular manufacturing, flexible manufacturing systems, transfer lines, manual and automated assembly systems, and quality control systems.
Prerequisites: ISE 215 or IE 215

ISE 444 Optimization Methods in Machine Learning 3 Credits
Machine learning models and optimization methods that are used to apply these models in practice. Convex models. Gradient and subgradient methods and their stochastic counterparts. Limits and errors of learning, noise reduction, and nonconvex models. Other techniques and algorithms include acceleration, coordinate descent, alternating-direction methods, first-order constrained convex optimization methods, and second-order methods.

ISE 447 Financial Optimization 3 Credits
Making optimal financial decisions under uncertainty. Financial topics include asset/liability management, option pricing and hedging, risk management and portfolio optimization. Optimization covered includes linear/nonlinear optimization, discrete optimization, dynamic programming and stochastic optimization. Emphasis on use of modeling languages and solvers in financial applications. Requires basic knowledge of linear optimization and probability. This course is a graduate version of ISE 347. A student cannot receive credit for both ISE 347 and ISE 447.
Prerequisites: ISE 426

ISE 455 Optimization Algorithms and Software 3 Credits
Basic concepts of large families of optimization algorithms for both continuous and discrete optimization problems. Pros and cons of the various algorithms when applied to specific types of problems; information needed; whether local or global optimality can be expected. Participants practice with corresponding software tools to gain hands-on experience. This course is a version of ISE 355 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 355 and ISE 455.

ISE 456 Conic Optimization 3 Credits
Modeling, theory, solution algorithms, and applications of conic optimization. Topics include mathematics of conic optimization: second-order cones, semidefinite cones, conic duality, interior-point methods. Applications of conic optimization to combinatorial optimization and other areas of optimization are covered.

ISE 458 Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations. Applications include strategic pricing, negotiations, voting, contracts and economic incentives, and environmental issues. This course is a version of ISE 358 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 358 and ISE 458.

ISE 462 Logistics and Supply Chain Management 3 Credits
Modeling and analysis of supply chain design, operations, and management. Analytical framework for logistics and supply chains, demand and supply planning, inventory control and warehouse management, transportation, logistics network design, supply chain coordination, and financial factors. Students complete case studies and a comprehensive final project. This course is a version of ISE 362 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 362 and ISE 462.

ISE 464 Introduction to Machine Learning 3 Credits
Techniques of applied machine learning rather than deep theory behind the algorithms and methods. Programming solutions for machine learning problems using a high-level programming language and associated machine learning libraries. Regression, clustering, principal component analysis, Bayesian methods, decision trees, random forests, support vector machines, and neural networks. This course is a version of ISE 364 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 364 and ISE 464.

ISE 465 Applied Data Mining 3 Credits
Introduction to the data mining process including business problem understanding, data understanding and preparation, modeling and evaluation, and model deployment. Emphasis on hands-on data preparation and modeling using techniques from statistics, artificial intelligence, such as regression, decision trees, neural networks, and clustering. A number of application areas are explored. This course is a version of ISE 365 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 365 and ISE 465.

ISE 471 Quality and Process Improvement in Healthcare 3 Credits
The dimensions of Healthcare quality and their definitions, quality metrics, accreditation and other benchmarking and evaluation methods. Change management, project planning and team management. Continuous improvement tools including “lean”, “six-sigma”, and “TQM”. This course is a version of ISE 371 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 371 and ISE 471.

ISE 472 Financial Management in Healthcare 3 Credits
Engineering economics in Healthcare; value metrics (net present value, return on investment, etc.), cost-benefit analysis, capital projects and improvements. Accounting methods in Healthcare systems. Reimbursement methods, organizations, and alternatives. Financial strategy, planning, pricing and capital formation in “for”, and “not for” profit settings. This course is a version of ISE 372 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 372 and ISE 472.

ISE 480 ISE Project 1-3 Credits
Intensive study of an area of industrial and systems engineering with emphasis upon design and application. A written report is required.
Repeat Status: Course may be repeated.

ISE 481 HSE Project 1-3 Credits
Intensive study in health systems engineering with an emphasis upon design and application. Written report is required.
Repeat Status: Course may be repeated.

ISE 482 Leadership Development 3 Credits
Exploration and critical analysis of theories, principles, and processes of effective leadership. Managing diverse teams, communication, and ethics associated with leadership. Application of knowledge to personal and professional life through projects and team assignments. This course is a version of ISE 382 for graduate students, with advanced assignments. A student cannot receive credit for both ISE 382 and ISE 482.

ISE 485 Industrial Engineering Special Topics 1-3 Credits
An intensive study of some field of industrial engineering.
Repeat Status: Course may be repeated.

ISE 486 Operations Research Special Topics 1-3 Credits
An intensive study of some field of operations research.
Repeat Status: Course may be repeated.

ISE 487 Professional Development 0 Credits
Discuss and learn how to implement the tools needed to successfully navigate the employment market, as well as guide students through the process of pursuing a job and internship opportunities.

ISE 489 Readings 1-3 Credits
Intensive readings-based course of some topic in industrial and systems engineering.
Repeat Status: Course may be repeated.

ISE 490 Thesis 1-6 Credits
Thesis course.
Repeat Status: Course may be repeated.

ISE 499 Dissertation 1-15 Credits

Management Science and Engineering

The Management Science and Engineering program is directed toward integrating scientific methods with the functional aspects of organizations by investigating the application of quantitative methodology and systems analysis in the context of decision making, risk analysis, economics and cost analysis, production management, and supply chain logistics. This integration provides the students with a broader perspective toward managerial decision-making in both private enterprise and public administration.

Midcareer professionals and recent graduates with a background in engineering, mathematics, and physical sciences who intend to seek managerial, consulting or systems analyst positions are appropriate candidates. In particular, those candidates who intend to seek positions demanding both technical and management skills find the management science background advantageous in dealing with the complex problems of industrial, commercial, and public service organizations.

The Industrial and Systems Engineering Department administers the Management Science and Engineering program. To be admitted to the program a candidate must demonstrate basic competence in calculus, statistics, linear algebra, introductory operations research, accounting, production and economics. A candidate lacking appropriate background may be required to take background courses. The minimum program consists of 30 credit hours of course work, of which at least 18 credit hours must be in the 400-level. The ISE graduate faculty coordinator must approve all course work. No more than 9 credit hours may be taken from the College of Business.

M.S. IN MANAGEMENT SCIENCE AND ENGINEERING

The minimum program for the master of science degree in Management Science & Engineering consists of 24 credit-hours of approved courses and completion of a satisfactory 6 credit thesis. A faculty member must supervise the thesis. Courses from outside the ISE department usually include other engineering disciplines, mathematics, computer science, and business and economics.

M.ENG. IN MANAGEMENT SCIENCE AND ENGINEERING

The minimum program for the master of engineering degree in Management Science & Engineering consists of 30 credit-hours of coursework (which can include a 3 credit-hour project). This program of study is for those students whose interests are geared toward engineering design rather than research. A faculty member must supervise the project.

MANAGEMENT SCIENCE AND ENGINEERING CORE COURSES

Details on course requirements for the Management Science and Engineering master's degree can be found at Master's Program web page (https://ise.lehigh.edu/content/masters-programs-courses/#Management) or at the Industrial and Systems Engineering office.

Materials Science and Engineering

Materials Science and Engineering provides the skills to discover, improve, and test new materials to enable advanced engineering technologies to address the most complex problems of the society. From space exploration to sustainable packaging, MSE is the leading engineering degree when it comes to the development of a safe and clean future. Lectures and laboratories with strong computational fundamentals will equip students to understand complex issues and challenges of materials' performance and how to design effective engineering solutions.

The **undergraduate program** in Materials Science and Engineering brings the foundation of materials engineering, educating students using engaging project-oriented methodologies. The curriculum covers from the foundations to application of materials in advanced technologies, such as materials for energy applications, including batteries and solar cells, to structural composites for vehicles and space exploration. The curriculum offers a 4-year degree with extensive opportunities for research experience, internships, and a number of hands-on laboratories integrating novel computational tools with processing techniques such as 3D printing and selective laser sintering. The program also offers a 4+1 opportunity, with a masters degree in the field with only 1 additional year of study.

The **graduate program** in Materials Science and Engineering offers advanced education for those interested in research and the development of their careers. Certificate, Master's, and Ph.D. programs build on each other to deliver complementary levels of education. Taking advantage of the strong research-oriented faculty at Lehigh University, students will engage and learn by experimenting research at the forefront of knowledge. The program is suitable for materials engineers to further advance in the field, but also for engineers from other areas, such as mechanical, electrical and bioengineering, so they can learn to navigate the complex challenges involving materials engineering solutions.

For more information please visit us at: https://materials.lehigh.edu/ **(**https://engineering.lehigh.edu/matsci/**)**

B.S. IN MATERIALS SCIENCE AND ENGINEERING

The undergraduate program in Materials Engineering is designed to prepare you to address the most challenging societal problems by giving you the tools to create, manipulate, test and invent new materials. You'll be prepared for operations, management, research, development, and sales careers in industry or for graduate study in various specialties of the field, including the improvement of properties in metals, ceramics, polymers, composites, electronic materials, and biomaterials. While some graduates go directly into materials-producing companies, some also work as 'general' engineers in the transportation, electronics, chemical, communications, space, and other industries. A number of students pursue graduate study leading to careers in research and teaching, medicine, or the law.

Materials Science and Engineering majors have opportunities to gain valuable experience in related fields, including other areas of engineering or science, by choosing to concentrate elective courses in one of these areas. Requirements for the Minor include acquiring at least 15 course credits in that area, which may be taken as technical or free electives in the student's major. It is particularly straightforward for students to obtain a minor in Chemical and Biomolecular Engineering, in Mechanical Engineering, in Nanotechnology, or in Polymer Science and Engineering. There is also a path to a Business minor.

Materials Science and Engineering majors can also participate in undergraduate research at overseas universities during the summer between the Junior and Senior years. The Materials Science and Engineering Industrial Option program enables students to gain work experience during the Senior Year. The Materials

Science and Engineering Research Option program provides senior undergraduates with research experience.

Five-Year programs are available to broaden the Materials Science and Engineering undergraduate experience. One such program is the Arts-Engineering Program, in which students can earn both the Bachelor of Science degree in Materials Science and Engineering and the Bachelor of Arts degree in some area within the College of Arts and Sciences, such as biology, physics, chemistry, or history. Another is the B.S./M.Ed. Program, which leads (in five years of study and internships) to the B.S. degree in Materials Science and Engineering and a masters degree (M.Ed.) in Education, with elementary or secondary teacher certification.

MINOR IN MATERIALS SCIENCE AND ENGINEERING

The Department of Materials Science and Engineering offers minors to students majoring in other subjects. The Department is enthusiastic in its support of students who wish to broaden their education by taking a minor. To obtain a minor in Materials Science and Engineering, a student must complete:

MAT 033	Engineering Materials and Processes	3
MAT 10 or MAT 028 may be used as an elective. The remaining courses may be chosen from a list of 200 and 300 level courses relevant to various engineering disciplines. List is maintained by the department.		12
Total Credits		**15**

MINOR IN NANOTECHNOLOGY

Materials for nanotechnology applications have new properties unavailable in bulk materials. The synthesis, processing, and characterization of these materials require facility with concepts beyond those needed for typical engineering materials. This minor requires:

MAT 355	Materials for Nanotechnology	3
One course on crystallography and band theory		3
Additional electives		9
Total Credits		**15**

Additional requirement: Since the aim of this minor is to provide an interdisciplinary program in nanotechnology, students must take at least **one** course outside their home department. Courses of individual study (including laboratory projects) on relevant topics, in any appropriate department, will also be accepted as electives for the minor, with the approval of the advisor.

EDUCATIONAL MISSION

The Materials Science and Engineering undergraduate program's mission is to pursue excellence and international prominence in the selection, design, synthesis, characterization, and discovery of materials at the nexus of experimental, computational, and data science techniques through distinguished research and scholarship, innovative teaching, industrial relationships, and active professional leadership. Our goal is to nurture and champion leaders who think critically, analytically, and broadly about grand challenges, both old and new, in an effort to improve the world around them.

PROGRAM EDUCATIONAL OBJECTIVES

· Graduates will have the knowledge and experience to pursue successful careers;

· Graduates will meet the expectations of employers;

· Qualified graduates will be admitted to highly ranked advanced degree programs; and

· Successful careers will be reflected in professional recognition, advancement in responsibility, and awards.

STUDENT OUTCOMES

The MS&E undergraduate Student Outcomes declare that graduates should have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;

3. an ability to communicate effectively with a range of audiences;

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global economic, environmental, and societal contexts;

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions;

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

MAJOR REQUIREMENTS

The recommended sequence of courses is shown below.

A total of 132 credits or more is required to graduate.

First Year

First Semester	Credits	Second Semester	Credits
MATH 021	4	MATH 022	4
WRT 001	3	WRT 002	3
ENGR 005	2	PHY 011[1]	4
ENGR 010	2	PHY 012[1]	1
CHM 030[1]	4	Select one of the following:	4
		ECO 001	4
		Humanities or Social Sciences Elective	4
	15		**16**

Second Year

First Semester	Credits	Second Semester	Credits
MAT 033[2]	3	MAT 203	3
MAT 010	3	MAT 205	3
MATH 023	4	MAT 218	3
PHY 021	4	MAT 204	3
PHY 022	1	Humanities or Social Science Elective	3
Free Elective	3		
	18		**15**

Third Year

First Semester	Credits	Second Semester	Credits
MAT 020	3	MAT 206	3
MAT 216	3	MAT 214	3
MAT 101	2	MAT 201	3
MATH 205	3	Engineering Science Elective	3
MECH 003	3	Free Elective	3
Select one of the following:	4	MAT 211	3
ECO 001	4		
Humanities or Social Science Elective	4		
	18		**18**

Fourth Year

First Semester	Credits	Second Semester	Credits
MAT 252	3	MAT 268	3

Engineering Science Elective	3	CHE 280	3
Approved Elective	3	ECE 083	3
Humanities or Social Science Elective	4	ECE 162	1
MAT 212	2	Free Elective	3
		Humanities or Social Science Elective	4
	15		**17**

Total Credits: 132

1

Required natural science courses, one taken fall semester and the other taken in spring

2

MAT 033 is taught in both the fall and spring semesters

PROGRAM REQUIREMENTS

Students must achieve a grade of C- or better in all required courses, in addition to a major GPA of 2.0.

ELECTIVES

Electives for the sophomore, junior, and senior years must be distributed as follows:

Humanities and Social Sciences: 13-15 credit hours.

Free Electives: 9 credit hours in any department.

Approved Elective (3 credit hours) and Engineering Science Electives (6 credit hours) must be selected from a specific list supplied by the Materials Science and Engineering Department. The list includes the Industrial Option and the Research Option.

PROGRAM OPTIONS

Recognizing that the field of materials science and engineering may be pursued in either an industrial setting or a research setting, the department offers three elective options to prepare students for these careers: The Co-Op Program, the Industrial Option, and the Research Option.

Co-Op Program

The department's optional Co-Op program, operated within the College of Engineering and Applied Science, provides opportunities for integration of academic studies with significant periods of engineering practice. The program provides eight months of paid, full-time work at selected companies, while still allowing the student to graduate in four years. To be considered for this program, the student should discuss application requirements with his or her advisor.

Industrial Option		
MAT 327	Industrial Project	4
MAT 329	Industrial Project	4
Research Option		
MAT 340	Research Techniques	3
MAT 341	Undergraduate research	3

Industrial Option

The Industrial Option introduces students to the work of materials engineers in industry. The emphasis is a team approach to the solution of actual plant problems. The courses are conducted in cooperation with local industries. 20 hours per week are spent at the plant of the cooperating industry on investigations of selected problems. The option is limited to a small group of seniors, selected by the Department from those who apply. Summer employment is provided when possible for those who elect to initiate the program during the summer preceding the senior year.

Research Option

The Research Option is offered for students interested in research and development. Financial support may be available for students who elect to initiate a research program during the summer preceding the senior year. The option is limited to a small group of students, selected by the Department from those who apply.

FOR GRADUATE STUDENTS

The department offers graduate degrees in Materials Science and Engineering at both masters (M.S. and M. Eng.) and doctoral levels (Ph.D.). Specialized masters degree programs are also available in Photonics, in Polymers, and in Business Administration and Engineering (MBA&E). The M.S. Degree in Photonics is an interdisciplinary degree for broad training in such topics as fiber optics, light-wave communications, and optical materials, to prepare students for work in industry or for further graduate research at the Ph.D. level. The program requires a total of 30 credits of graduate work, including a 15-credit core of courses in materials, electrical engineering, and physics. The Polymer Science and Engineering Program offers interdisciplinary M.S. and Ph.D. degrees through several departments, including Materials Science and Engineering. The program includes courses in materials, chemical engineering, chemistry, physics, and mechanical engineering. The MBA&E is an interdisciplinary degree program in business and engineering designed primarily for students with an undergraduate degree in engineering and two years or more of relevant work experience. The curriculum consists of an MBA core and electives (23 credits) and an engineering core and electives (18 credits), plus other electives and a project which integrates business and engineering (4 credits). Students wishing to have the engineering core in Materials Science and Engineering may enter this program through the Materials Science and Engineering Department.

SPECIAL PROGRAMS AND OPPORTUNITIES

The department has established specific recommended programs for the M.S., the M.Eng., and the Ph.D., emphasizing the following areas: metals processing and performance, ceramics and glass processing and properties, electronic and photonic materials, polymer modification, processing and characterization, biomaterials, electron microscopy and microstructural characterization.

These programs are flexible and often interdisciplinary.

Major Requirements

A candidate for the M.S. completes a thesis, unless fully funded by industry, in which case a thesis is not required. M.S. thesis research normally represents six of the 30 semester hours required for this degree. Candidates for the M.Eng. complete a three-credit engineering project.

A candidate for the Ph.D. prepares a preliminary program of courses and research, providing for specialization in some field (largely through research) in consultation with the adviser. Prior to formal establishment of the doctoral program by the special committee and its approval by the college, the student passes a qualifying examination that must be taken in the first or second year of doctoral work. The department does not require a foreign language. It does require preparation and defense of a research proposal as a portion of the general examination.

Of the courses listed only those in the 300 series are available for graduate credit. There are many additional offerings in materials under the listings of other departments.

Most graduate students receive some form of financial aid. Several kinds of fellowships and assistantships are available. This type of aid generally provides for tuition, and a stipend. For details of graduate scholarships, fellowships, and assistantships, please refer to the Financial Aid (p. 43) section.

Research Activities

Graduate students conduct their research in facilities located in the Department or other centers and institutes. The following list describes current Materials Science and Engineering research activities:

Metals Processing and Performance

Joining of metals and alloys, additive manufacturing, solidification modeling, deformation processing, grain boundary cohesion, high entropy materials.

Ceramics and Glass Processing and Properties
Fundamental studies of sintering and grain growth, novel reaction-based processing for bulk and thin film ceramics, microstructure and properties of oxides for environmental coatings, growth of single crystal piezoelectric ceramics, creep and grain boundary chemistry of alumina, dielectric and electrical properties of glasses, corrosion of glass.

Electronic and Photonic Materials
Thin films synthesis and characterization, novel wide-bandgap semiconductors, degradation processes in light-emitting semiconductors, bulk single crystal growth, reliability of MEMS materials, polymer packaging materials, glass nanostructure and chemistry, glasses for nonlinear optical applications, transparent glass ceramics, photo-induced phenomena, and photovoltaics.

Polymer Modification, Processing and Characterization
Polymer conjugation and chemical modification, cure kinetics, melt compounding and extrusion, surface characterization, adhesion, additive manufacturing, degradation behavior, mechanical properties, and thermal analysis.

Biomaterials
Synthesis of biomaterials, biophysics, biomimicry, fabrication, chemical functionalization, characterization methods, biological materials, and application-driven design.

Electron Microscopy and Microstructural Characterization
Transmission electron microscopy, scanning electron microscopy, nanoscale compositional mapping, cathodoluminescence microscopy and spectroscopy, x-ray diffraction and fluorescence, x-ray microanalysis, electron-loss spectrometry, extended x-ray absorption and electron energy loss fine structure.

Courses

MAT 010 Materials Laboratory 0,3 Credits
Introduction to experimental methods used to fabricate and measure the structure and properties of materials. Thermal and mechanical processing and properties are emphasized. Specimen preparation and examination by light optical microscopy.
Prerequisites: MAT 033
Can be taken Concurrently: MAT 033

MAT 020 Computational Methods in Materials Science 0,3 Credits
The use of computers and computational methods to solve problems in materials science and engineering. Students will employ both commercial packages and their own code in order to complete assignments. Students will utilize word processing and display packages to present results of projects.
Prerequisites: ENGR 010

MAT 028 Silicon, Steel, or Styrofoam? Designing with Materials 3 Credits
A systematic methodology for selecting materials and fabrication processes in engineering design; case studies in which this methodology is used; overview of engineering materials and their properties; development of material performance indices; materials for environmentally conscious and sustainable design; industrial design considerations; design-directed development of new materials. No previous engineering experience required.
Prerequisites: PHY 009 and PHY 010 or PHY 011
Can be taken Concurrently: PHY 009, PHY 010, PHY 011

MAT 033 Engineering Materials and Processes 0,3 Credits
Application of physical and chemical principles to understanding, selection, and fabrication of engineering materials. Materials considered include metals, polymers, ceramics, composites, and electronic materials. Case studies of materials used range from transportation systems to microelectronic devices.

MAT 101 Professional Development 2 Credits
The role and purpose of engineering in society; the meaning of being a professional; engineering ethics; environmental issues; safety issues; communications and decision-making in the engineering process; expectations and problems of young engineers; personal goals; choosing a career. Required reading. Written reports based on library research.

MAT 107 Special Topics in Materials 1-3 Credits
A study of selected topics in materials science and engineering not covered in other formal courses. Consent of instructor required.

MAT 201 Physical Properties of Materials 3 Credits
Basic concepts of modern physics and quantum mechanics needed for an understanding of electrons in solids. The experimental development leading to wave mechanics is emphasized. Uses of the Schrodinger equation as the basis for the free electron theory of metals and band theory. Optical properties are developed leading to a discussion of lasers.
Prerequisites: PHY 021 and MAT 033 and MATH 205

MAT 203 Materials Structure at the Nanoscale 0,3 Credits
The structure of metals, ceramics, semiconductors, and polymers at the atomic scale. Crystalline, semicrystalline, liquid crystalline and amorphous (glassy) states. Fundamental aspects of formal crystallography and crystal structures. Point, line, and planar crystal defects. Materials characterization by x-ray diffraction, light microscopy, electron microscopy, and other techniques.
Prerequisites: CHM 030 and MAT 033 and MAT 010
Can be taken Concurrently: MAT 033

MAT 204 Processing and Properties of Polymeric Materials 0,3 Credits
The structure-property relationships in polymers will be developed, emphasizing the glass transition, rubber elasticity, crystallinity, and mechanical behavior. Elements of polymer processing. Extrusion of plastics and films, and fiber spinning operations.
Prerequisites: MAT 033

MAT 205 Thermodynamics of Macro/Nanoscale Materials 3 Credits
The three laws of thermodynamics. Gibbs free energy and conditions of equilibrium. Effects of scale on material behavior. Binary and ternary equilibrium phase diagrams. Application of thermodynamics to materials problems, with examples from nanotechnology, biotechnology, and structural materials.
Prerequisites: MATH 023 and MAT 033
Can be taken Concurrently: MATH 023, MAT 033

MAT 206 Processing and Properties of Metals 3 Credits
The production and purification of metals, their fabrication, and control of their properties. Includes topics such as precipitation hardening, hot and cold working, and casting.
Prerequisites: MAT 218 and MAT 216

MAT 211 (BIOC 211, BIOE 211, ENGR 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
Prerequisites: MAT 010 and MAT 033 and MAT 205 and MAT 218 and MAT 203
Can be taken Concurrently: MAT 203

MAT 212 (BIOC 212, BIOE 212, ENGR 212, ME 212) Capstone Design Project II 2 Credits
Students continue developing their solutions from MAT 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
Prerequisites: MAT 211 and MAT 216
Can be taken Concurrently: MAT 216

MAT 214 Processing and Properties of Ceramic Materials 0,3 Credits
General overview of the compositions, properties and applications of ceramic materials. The theory and practice of fabrication methods for ceramics and glasses. Methods of characterization. Selected properties of ceramic materials.
Prerequisites: MAT 033

MAT 216 Diffusion and Phase Transformations 0,3 Credits
Fundamental diffusion equations; liquid-solid transformations; solid-solid transformations; transformation kinetics; metastable transformations; diffusionless transformations; examples of various transformations in different materials and their effect on properties.
Prerequisites: MAT 203 and MAT 205

MAT 218 Mechanical Behavior of Macro/Nanoscale Materials 0,3 Credits
Elasticity, plasticity, and fracture of metals, ceramics, polymers, and composites. The roles of defects and size scale on mechanical response. Strengthening and toughening mechanisms in solids. Statics and time-dependent failures from microstructural and fracture mechanics viewpoints. Lectures and laboratories.
Prerequisites: MAT 033 and MAT 010

MAT 252 Electronic Properties of Materials 3 Credits
Electronic structure of materials, i.e., band and zone theory, is presented from a physical point of view. Electrical conductivity in metals, semiconductors, insulators and superconductors discussed. Simple semiconductor devices reviewed. Magnetic properties examined in the context of domain theory and applications. Optical and dielectric properties of semiconductors and ferroelectrics are considered.
Prerequisites: MAT 201 and MAT 203

MAT 268 Failure Analysis Reports 3 Credits
Application of chemical and mechanical failure concepts, microstructural analysis, and fracture surface characterization to the analysis and prevention of engineering component failures. Materials selection from databases of AISI standard alloys. Laboratory investigations on component failures using ASTM standard testing methods. Written and oral presentations of the results. Must have senior standing.
Prerequisites: MAT 204 and MAT 206 and MAT 214

MAT 300 Apprentice Teaching 3 Credits

MAT 309 (ME 309) Composite Materials 3 Credits
Principles and technology of composite materials. Processing, properties, and structural applications of composites, with emphasis on fiber-reinforced polymers.
Prerequisites: MAT 033 or MECH 003

MAT 310 Independent Study in Materials 1-3 Credits
Provides an opportunity for advanced, independent study of selected topics in materials science and engineering not covered in other formal courses.
Repeat Status: Course may be repeated.

MAT 311 (BIOE 311) Introduction to Biomaterials 3 Credits
Application of materials science and engineering principles to biomedical materials with a focus on polymers, ceramics, and metals. Synthesis and fabrication of biomaterials, structure-property-function relationships related to biocompatibility and bioactivity; nano- to macro-scale characterization; material-tissue interactions; and applications of biomaterials including implants, devices, drug delivery, tissue engineering and regenerative medicine.
Prerequisites: MAT 033

MAT 314 (ME 314) Metal Forming Processes 3 Credits
Mechanical metallurgy and mechanics of metal forming processes. Yield criteria. Workability. Friction and lubrication. Engineering analysis of forging, extrusion, wire and tube drawing, rolling, sheet forming and other processes. Recent developments in metal forming. Credit is not given for both MAT 314 and MAT 414.
Prerequisites: MAT 206

MAT 315 Physical Properties of Structural and Electronic Ceramics 3 Credits
Structure-property relationships in ceramics. Mechanical behavior including plasticity, hardness, elasticity, strength and toughening mechanisms. Thermal behavior including specific heat, thermal expansion, thermal conduction and thermal shock. Electrical behavior including application of tensors and crystal physics to electroceramics.
Prerequisites: MAT 214

MAT 316 Optical Properties of Materials 3 Credits
Interaction of electromagnetic waves with solid, liquid, and gaseous matter: reflection, refraction, polarization, diffraction, scattering, absorption, and luminescence. Factors determining the perceived color of metals, ceramics, polymers, semiconductors, biomaterials, and various nanostructured materials. Overview of the technological applications of optical materials in coatings, lighting, display technologies, lasers, solar cells, and optical communications. Credit will not be given for both MAT 316 and MAT 416.
Prerequisites: MAT 033

MAT 317 Imperfections in Crystals 3 Credits
The major types of crystal defects and their role in controlling the properties of materials. Point, line and planar defects, their atomic configurations and experimental techniques to study their characteristics. Emphasis on the role of dislocations and grain boundaries in the control of mechanical properties.
Prerequisites: MAT 203

MAT 318 (BIOE 318, CHE 318) Soft Materials: Rheology and Characterization 3 Credits
Characterization of soft materials using rheological techniques. Fundamentals of rheology and rheological characterization applied to materials such as polymers, glassy liquids and polymeric gels. Closed to students who have taken CHE/BIOE/MAT 418. Instructor permission or graduate status required.

MAT 319 Current Topics in Materials Science 3 Credits
Selected topics of current interest in the field of materials engineering but not covered in the regular courses. Consent of department required.
Repeat Status: Course may be repeated.

MAT 320 Analytical Methods in Materials Science 3 Credits
Selected topics in modern analysis and their application to materials problems in such areas as thermodynamics, crystallography, deformation and fracture, diffusion.
Prerequisites: MATH 231 or MATH 205

MAT 324 (BIOE 324) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular and system level; general introduction to biosensors, drug delivery devices and tissue engineering. Consent of instructor required.
Prerequisites: BIOE 110 or MAT 204

MAT 325 (BIOE 325) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis).
Prerequisites: MAT 033

MAT 326 (BIOE 326) Biomimetic and Bio-enabled Materials 3 Credits
The structure, function, properties and use of biopolymers, biocomposites, and biominerals. Biomimetic materials design, including colloids, interfaces, macromolecules, and applications of such materials. Environmental and ethical considerations, such as degradation products when using biomimetic materials. Closed to students who have taken MAT 426 (BioE 426).
Prerequisites: MAT 033 or BIOE 110
Attribute/Distribution: ND

MAT 327 Industrial Project 4 Credits
Restricted to a small group of seniors and graduate students selected by the department from those who apply. Two full days per week are spent on development projects at the plant of an area industry, under the direction of a plant engineer and with faculty supervision.

MAT 329 Industrial Project 4 Credits
To be taken concurrently with MAT 327. Material is the same as MAT 327.

MAT 332 Basics of Materials Science and Engineering 0,3 Credits
Physical and chemical principles applied to understanding the structure, properties, selection, fabrication, and use of engineering materials: metals, polymers, ceramics, composites and electronic materials. Case studies of materials used ranged from transportation systems to microelectronic devices. Lectures and individual study assigned by graduate advisor. Must have graduate student status. Consent of department required. Not available to students who have taken MAT 033 or equivalent.

MAT 333 Crystallography and Diffraction 3 Credits
Introduction to crystal symmetry, point groups, and space groups. Emphasis on materials characterization by x-ray diffraction and electron diffraction. Specific topics include crystallographic notation, stereographic projections, orientation of single crystal, textures, phase identification, quantitative analysis, stress measurement, electron diffraction, ring and spot patterns, convergent beam electron diffraction (CBED), and space group determination. Applications in mineralogy, metallurgy, ceramics, microelectronics, polymers, and catalysts. Lectures and laboratory work. Senior standing in chemistry.
Prerequisites: MAT 203 or EES 133

MAT 334 (CHE 334) Electron Microscopy and Microanalysis 0,4 Credits
Fundamentals and experimental methods in electron optical techniques including scanning electron microscopy (SEM), conventional transmission (TEM) and scanning transmission (STEM) electron microscopy. Specific topics covered will include electron optics, electron beam interactions with solids, electron diffraction and chemical microanalysis. Applications to the study of the structure of materials are given. Consent of department required.

MAT 340 Research Techniques 3 Credits
Study and application of research techniques in materials science and engineering. Research opportunities, design of experimental programs, analysis of data, presentation of results. Selection of research topic and preparation and defense of research proposal. Restricted to a small number of students selected by the department from those who apply.

MAT 341 Undergraduate research 3 Credits
Application of research techniques to a team-based project in materials science and engineering selected in consultation with the faculty and advised by at least one faculty member in Materials Science and Engineering. Thesis writing in consultation with faculty advisor and mentors. Preceded by MAT 340. Department permission required.

MAT 342 Inorganic Glasses 3 Credits
Definition, formation and structure of glass; common glass systems; manufacturing processes; optical, mechanical, electrical and dielectric properties; chemical durability; glass fibers and glass ceramics. Lectures and laboratories.
Prerequisites: MAT 033

MAT 345 Additive Manufacturing and Powder Metallurgy 3 Credits
Application of powder metallurgy in emerging technologies in the field of Additive Manufacturing (aka 3-D Printing). Metal powder fabrication and characterization methods. Powder processing including powder compaction, theory of compacting, press and die design, sintering, hot consolidation and additive manufacturing. Microstructure and properties of sintered materials and their relationship to processing conditions. Industrial applications. Emerging powder metallurgy technologies. Credit will not be given for both MAT 345 and MAT 445.
Prerequisites: MAT 206 or ISE 215 or ME 240

MAT 346 Physical Metallurgy of Welding 3 Credits
Operational characteristics of welding processes. Application of solidification and solid state transformation theory to understanding microstructural development in welds, and influence of welding on properties. Metallurgical defects in welds. Computational techniques for predicting heat flow and phase transformations in welds of complex engineering alloys. Laboratory demonstrations.
Prerequisites: MAT 216

MAT 350 Effective Scientific Communication: Proposals, Figures, Papers, and Presentations 2 Credits
Effective communication is essential for scientists and engineers. In this course we discuss best practices for effective communication in the form of proposals, figures, presentations, and manuscripts. Students will develop their own materials based on their current or prior work that will undergo peer- and faculty-review. This course is targeted for first- and second-year graduate students but senior undergraduate students intent on attending graduate school may also enroll.
Repeat Status: Course may be repeated.

MAT 355 Materials for Nanotechnology 3 Credits
An introduction to the nanoworld and how we observe the nanoworld through transmission electron microscopy. Other topics include: probing nanosurfaces, carbon as a nanomaterial, fullerenes, carbon nanotubes, metal clusters, metal nanoparticle preparation, and directed self-assembly of nanoparticles. Also discussed are the thermal, chemical, electronic, optical, and magnetic properties of metal nanoparticles, nanowires, semiconductor nanoparticles, and inorganic nanoparticles.

MAT 356 Strategies for Nanocharacterization 3 Credits
Lectures describe various nanocharacterization techniques in terms of which technique is best for specific measurements on nanostructures less than 100 nm in extent. Special attention is paid to spatial resolution and detection limits for SEM, TEM, X-ray analysis, diffraction analysis, ion beam techniques, surface techniques, AFM and other SPMs, and light microscopies and spectroscopies.

MAT 359 Thin Film Deposition, Processing, and Characterization 3 Credits
Thin films are at the heart of electronics, optics, medicine, and nanotechnology. Fundamental and applied aspects of thin film deposition, processing, and characterization. Growth methods including physical and chemical deposition techniques. Equipment and hardware for deposition and analysis. Structural, mechanical, electronic, and chemical properties of films. Processing methods and their relationship to specific applications. Must have Junior or Senior level standing.

MAT 363 Computational Methods in Science and Engineering 3 Credits
Computer simulation of systems at various length and time scales. Atomistic simulation (molecular dynamics and Monte Carlo) methods are presented and applied to models described by simple interatomic potentials. Mesoscale simulation is described in the context of domain growth and, at the continuum scale, finite-difference and finite-element methods are employed to model heat conduction and mass diffusion. Lecture and computer laboratory sessions. Credit will not be given for both MAT363 and MAT463.

MAT 386 Polymer Nanocomposites 3 Credits
Synthesis, morphology and properties of polymer nanocomposites. Comparisons with traditional particulate composites will be made and models predicting properties will be emphasized. Melt viscosity, mechanical properties, barrier properties and flame retardancy will be discussed. Credit is not given for both MAT 386 and MAT 486.
Prerequisites: MAT 204 or MAT 393

MAT 388 (CHE 388, CHM 388) Polymer Characterization 3 Credits
Description of molecular weight measurements using dilute solutions (solution viscosity, size exclusion chromatography, osmotic pressure, and light scattering). Introduction to polymer thermal analysis techniques such as differential scanning calorimetry (DSC) , dynamic mechanical analysis (DMA), and thermomechanical analyzer (TMA). Discussion of structure and morphology of polymers and polymer blends using nuclear magnetic resonance (NMR), infrared spectroscopy (IR), Raman spectroscopy, UV analysis, transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM). Crystallinity measurements using SANS, SAXS, and WAXS.
Prerequisites: MAT 033 or MAT 204 or MAT 392 or MAT 393

MAT 392 (CHE 392) Introduction to Polymer Science 3 Credits
Introduction to concepts of polymer science. Kinetics and mechanism of polymerization, synthesis and processing of polymers, characterization. Relationship of molecular conformation, structure and morphology to physical and mechanical properties.

MAT 393 (CHE 393, CHM 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single- and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT.

MAT 401 Thermodynamics 0,3 Credits
Fundamentals of thermodynamics, as related to materials processes, including both hard and soft materials. Coverage of topics in classical and statistical thermodynamics, including the laws of thermodynamics, conditions of equilibrium, free energies, and thermodynamics of surfaces and phase transitions.

MAT 402 (ME 402) Advanced Manufacturing Science 3 Credits
The course focuses on the fundamental science-base underlying manufacturing processes, and applying that science base to develop knowledge and tools suitable for industrial utilization. Selected manufacturing processes representing the general classes of material removal, material deformation, material phase change, material flow, and material joining are addressed. Students create computer-based process simulation tools independently as well as utilize leading commercial process simulation packages. Laboratory experiences are included throughout the course.

MAT 403 Structure/Property Relations 4 Credits
Structure of materials and relationship to properties. Crystal structures and crystalline defects, structure in biological systems, amorphous materials, microstructure, and relationships to mechanical and other properties.

MAT 405 Kinetics 3 Credits
Derivation of fundamental diffusion equations and their application to single and multicomponent systems. Theoretical models of nucleation and growth (including spinodal decomposition), atomistic description of diffusion, influence of concentration/potential gradients and effects of temperature and pressure, and comparison with experimental observations. Kinetics of solid-state transformations, including phase transformations and particle coarsening.

MAT 406 Solidification 3 Credits
Structure, theory and properties of liquids. Homogeneous and heterogeneous nucleation theory and experimental results. Solidification phenomena in pure, single and multiphase materials including the nature of the freezing interface, segregation, constitutional super-cooling, dendritic growth, crystallographic effects, the origin of defects, crystal growing, zone processes. Consent of department chair required.

MAT 409 Current Topics in Materials 3 Credits
Recent practical and theoretical developments in materials. This course may be repeated for credit if new material is covered. Consent of department required.
Repeat Status: Course may be repeated.

MAT 411 (BIOE 411) Introductions to Biomaterials 3 Credits
Application of materials science and engineering principles to biomedical materials with a focus on polymers, ceramics, and metals. Synthesis and fabrication of biomaterials, structure-property-function relationships related to biocompatibility and bioactivity; nano- to macro-scale characterization; material-tissue interactions; and applications of biomaterials including implants, devices, drug delivery, tissue engineering and regenerative medicine. MAT 411 will require project-based study. Credit will not be given for both MAT 311 and MAT 411.
Prerequisites: MAT 033

MAT 414 Metal Forming Processes 3 Credits
Mechanical metallurgy and mechanics of metal forming processes. Yield criteria. Workability. Friction and lubrication. Engineering analysis of forging, extrusion, wire and tube drawing, rolling, sheet forming, and other processes. Recent developments in metal forming. Graduate version of MAT 314 requiring additional assignments. Credit is not given for both MAT 314 and MAT 414.
Prerequisites: MAT 206

MAT 415 Mechanical Behavior of Ceramic Solids 3 Credits
Strength, elasticity, creep, thermal stress fracture, hardness, abrasion and high-temperature deformation characteristics of single- and multicomponent brittle ceramic solids. Statistical theories of strength, static and cyclic fatigue, crack propagation, fracture toughness. Correlation of mechanical behavior, microstructure, and processing parameters.

MAT 416 Optical Properties of Materials 3 Credits
Interaction of electromagnetic waves with solid, liquid, and gaseous matter: reflection, refraction, polarization, diffraction, scattering, absorption, and luminescence. Factors determining the perceived color of metals, ceramics, polymers, semiconductors, biomaterials, and various nanostructured materials. Overview of the technological applications of optical materials in coatings, lighting, display technologies, lasers, solar cells, and optical communications. Additional coursework work will be required of students seeking the graduate level MAT 416 qualification. Credit will not be given for both MAT 316 and MAT 416.
Prerequisites: MAT 033

MAT 417 (BIOE 417, CHE 417) Soft Materials: Mechanics and Physics 3 Credits
Physical and mechanical behavior of soft materials such as gels, foams, rubbers, soft adhesives, and most biological tissue. Large strain kinematics, stress measures, constitutive relations from the molecular and continuum points of view, and application to problems such as cavitation, creasing, thin structures, fracture, adhesion, surface stress, and electroactive materials.
Prerequisites: CHE 452 or ENGR 452

MAT 418 (BIOE 418, CHE 418) Soft Materials: Rheology and Characterization 3 Credits
See the course description listed for CHE/BIOE/MAT 318. In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE/BIOE/MAT 318.

MAT 423 Advanced Transmission Electron Microscopy 0,4 Credits
The theory and practice of operation of the transmission and scanning transmission electron microscope. Techniques covered include bright field, high resolution and weak-beam dark field, lattice imaging, diffraction pattern indexing and Kikuchi line analysis. The theory of diffraction contrast is applied to the interpretation of electron micrographs. Specimen preparation techniques.
Prerequisites: MAT 334

MAT 424 (BIOE 424) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication, and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular, and system level; general introduction to biosensors, drug delivery, and tissue engineering. Graduate version of MAT 324 requiring additional assignments. Credit is not given for both MAT 324 (BioE 324) and MAT 424 (BioE 424).
Prerequisites: MAT 033

MAT 425 (BIOE 425) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis). Graduate version of MAT 325; credit will not be given for both MAT 325 and MAT 425.
Prerequisites: MAT 033

MAT 426 (BIOE 426) Biomimetic and Bio-enabled Materials 3 Credits
This course is a graduate version of MAT 326 (BIOE 326). While the lecture content will be the same as the 300-level course, students enrolled in MAT 426 (BIOE 426) will have more advanced assignments. Closed to students who have taken MAT 326 (BIOE 326). Requirements: Graduate standing in Bioengineering or Materials Science and Engineering.
Attribute/Distribution: ND

MAT 427 Advanced Scanning Electron Microscopy 0,4 Credits
The theory and practice of operation of the scanning electron microscope and electron microprobe. Techniques covered will include high-resolution scanning, quantitative electron probe microanalysis. Electron beam sample interactions, X-ray spectrometry, and electron optics will be discussed in detail.
Prerequisites: MAT 334

MAT 430 Glass Science 3 Credits
Definition and formation of glass. Structure of common inorganic (including metallic) and polymeric glass systems. Methods of glass making. Phase separation of devitrification. Physical properties including diffusion, electrical conductivity, chemical durability, and optical and mechanical properties. Special products including glass ceramics, optical fibers, photosensitive glasses, etc. Visit to a glass manufacturing plant may also be included.

MAT 431 Sintering Theory and Practice 3 Credits
Science and technology of the sintering of solid-state materials. Driving force and variables. Critical review of the sintering models. Coverage of single phase, multiphase and composite systems. Special sintering techniques such as fast firing, rate controlled sintering, hot pressing and transient second-phase sintering. Sintering of specific ceramic and metal systems.

MAT 442 Inorganic Glasses 3 Credits
Definition, formation and structure of glass; common glass systems; manufacturing processes; optical, mechanical, electrical and dielectric properties; chemical durability; glass fibers and glass ceramics. Lectures and laboratories. Credit is not given for both MAT 342 and MAT 442.

MAT 443 (CHM 443) Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nonoporous solids.

MAT 445 Additive Manufacturing and Powder Metallurgy 3 Credits
Application of powder metallurgy in emerging technologies in the field of Additive Manufacturing (aka 3-D Printing). Metal powder fabrication and characterization methods. Powder processing including powder compaction, theory of compacting, press and die design, sintering, hot consolidation and additive manufacturing. Microstructure and properties of sintered materials and their relationship to processing conditions. Industrial applications. Emerging powder metallurgy technologies. Graduate version of MAT 345 requiring additional assignments. Credit is not given for both MAT 345 and MAT 445.

MAT 450 Effective Scientific Communication: Proposals, Figures, Papers, and Presentations 2 Credits
Effective communication is essential for scientists and engineers. In this course we discuss best practices for effective communication in the form of proposals, figures, presentations, and manuscripts. Students will develop their own materials based on their current or prior work that will undergo peer- and faculty-review. This course is targeted for first- and second-year graduate students but senior undergraduate students intent on attending graduate school may also enroll.
Repeat Status: Course may be repeated.

MAT 455 Materials for Nanotechnology 3 Credits
An introduction to the nanoworld and how we observe the nanoworld through transmission electron microscopy. Other topics include: probing nanosurfaces, carbon as a nanomaterial, fullerenes, carbon nanotubes, metal clusters, metal nanoparticle preparation, and directed self-assembly of nanoparticles. Also discussed are the thermal, chemical, electronic, optical, and magnetic properties of metal nanoparticles, nanowires, semiconductor nanoparticles, and inorganic nanoparticles.

MAT 456 Strategies for Nanocharacterization 3 Credits
Lectures describe various nanocharacterization techniques in terms of which technique is best for specific measurements on nanostructures less than 100 nm in extent. Special attention is paid to spatial resolution and detection limits for SEM, TEM, X-ray analysis, diffraction analysis, ion beam techniques, surface techniques, AFM and other SPMs, and light microscopies and spectroscopies.

MAT 459 Thin Film Deposition, Processing, and Characterization 3 Credits
Thin films are at the heart of electronics, optics, medicine, and nanotechnology. Fundamental and applied aspects of thin film deposition, processing, and characterization. Growth methods including physical and chemical deposition techniques. Equipment and hardware for deposition and analysis. Structural, mechanical, electronic, and chemical properties of films. Processing methods and their relationship to specific applications. Graduate version of MAT 359 with extra assignments for graduate students. Credit will not be given for both MAT 359 and MAT 459.

MAT 460 Engineering Project 1-6 Credits
In-depth study of a problem in the area of materials engineering or design. The study is to lead to specific conclusions and be embodied in a written report. Intended for candidates for the M.Eng.
Repeat Status: Course may be repeated.

MAT 462 Independent Study 1-4 Credits
An intensive study, with report, of a topic in materials science and engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

MAT 463 Computational Methods in Science and Engineering 3 Credits
Computer simulation of systems at various length and time scales. Atomistic simulation (molecular dynamics and Monte Carlo) methods are presented and applied to models described by simple interatomic potentials. Mesoscale simulation is described in the context of domain growth and, at the continuum scale, finite-difference and finite-element methods are employed to model heat conduction and mass diffusion. Lecture and computer laboratory sessions. Extra assignments provided to graduate students. Credit will not be given for both MAT363 and MAT463.

MAT 482 (CHE 482, CHM 482) Mechanical Behaviors of Polymers 3 Credits
A treatment of the mechanical behavior of polymers. Characterization of experimentally observed viscoelastic response of polymeric solids with the aid of mechanical model analogs. Topics include time-temperature superposition, experimental characterization of large deformation and fracture processes, polymer adhesion, and the effects of fillers, plasticizers, moisture and aging on mechanical behavior.

MAT 483 (CHE 483, CHM 483) Emulsion Polymers 3 Credits
Examination of fundamental concepts important in the manufacture, characterization, and application of polymer latexes. Topics to be covered will include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

MAT 485 (CHE 485, CHM 485) Polymer Blends 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends. Polymer/polymer miscibility and thermodynamics of mixing of polymer/solvent and polymer/polymer blends. Prediction of miscibility using various theoretical models and methods that can be used to help enhance miscibility (H bonding etc.). Methods to enhance the compatibility of polymer/polymer blends (e.g., block copolymers, ternary addition, IPNs), etc.). Types of polymer blends. Must have completed any introductory polymer course or equivalent.

MAT 486 Polymer Nanocomposites 3 Credits
Synthesis, morphology and properties of polymer nanocomposites. Comparisons with traditional particulate composites will be made and models predicting properties will be emphasized. Melt viscosity, mechanical properties, barrier properties and flame retardancy will be discussed. This course is a version of MAT 386 for graduate students, with additional research projects and advanced assignments. Closed to students who have taken MAT 386. Credit is not given for both MAT 386 and MAT 486.
Prerequisites: MAT 204 or MAT 393 or MAT 393

MAT 487 Adhesion and Adhesives Technology 3 Credits
Basics of intermolecular forces, surface science, and mechanics of materials and how these relate to adhesion. Processing and design of adhesive joints. Formulation and behavior of pressure sensitive and structural adhesives. Background in polymers is helpful.

MAT 488 Polymer Characterization 3 Credits
Description of molecular weight measurements using dilute solutions (solution viscosity, size exclusion chromatography, osmotic pressure, and light scattering). Introduction to polymer thermal analysis techniques such as differential scanning calorimetry (DSC), dynamic mechanical analysis (DMA), and thermomechanical analyzer (TMA). Discussion of structure and morphology of polymers and polymer blends using nuclear magnetic resonance (NMR), infrared spectroscopy (IR), transmission electron microscopy (TEM) and atomic force microscopy (AFM).
Prerequisites: MAT 392 or MAT 393

MAT 489 Polymer Coatings 3 Credits
Film formation from solution and dispersion, and applications of coatings, mechanisms and kinetics of cured polymer systems, discussions of the variety of different types of coatings systems and their different applications; the methods used to characterize and test the coating; various methods used to process the polymers into a final coating and To examine in detail the various components that comprise a given polymer coating.
Prerequisites: MAT 392 or MAT 392

MAT 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

MAT 492 (CHE 492, CHM 492) Topics in Polymer Science 1-3 Credits
Intensive study of topics selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtonian flow behavior, second-order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.

MAT 494 Polymer Thermodynamics 3 Credits
Applications of thermodynamics in polymer science and engineering. Topics include: the thermodynamic basis for preparing polymer solutions, polymer blends and polymer composites, the importance of miscibility, phase separation and mechanical compatibilization of polymer solutions, polymer blends, etc., the methods used to characterize the role of thermodynamics; discussion of various thermodynamic models used to predict polymer compatibility and understand the importance of free energy of mixing. Understand the importance of thermodynamics in different application such as polymer crystallization, liquid polymers, etc.
Prerequisites: MAT 392 or MAT 393

MAT 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Mechanical Engineering and Mechanics

OUR MISSION

The mission of the Department of Mechanical Engineering & Mechanics is to:

1. Provide quality education and training to undergraduate and graduate students,

2. Develop new knowledge, and engineering methodology through research, and

3. Serve industry and society at large.

The undergraduate program provides students with the basic education they will need to function in an engineering environment, pursue graduate studies, continue their professional development, and establish an awareness of the culture and society in which we live. Because of technological innovations and the long-term demands of global competition, the department seeks to prepare our students to adapt to the rapid advances and changes in technology and to serve as agents and leaders in effecting these changes while being cognizant of the needs and concerns of society at large.

The graduate program bridges between the generalized undergraduate studies and the more focused research and remarkable accomplishments of our faculty. New graduate students participate in research by working closely with their faculty advisors; however, they are quickly encouraged to work and think independently, assuming greater responsibility for critical research functions. This learning process prepares the students for future research and development positions in industry or academia, where they can contribute to improving and advancing the community and society at large.

OUR FACULTY

A complete listing of the faculty can be found on our website (https://engineering.lehigh.edu/meche/faculty/).

B.S. IN MECHANICAL ENGINEERING

Mechanical engineering is one of the broadest of the engineering professions, dealing generally with systems for energy conversion, material transport and the control of motions and forces.

Mechanical engineers may choose from among many different activities in their careers, according to their interests and the changing

needs of society. Some concentrate on the conversion of thermal, nuclear, solar, chemical and electrical energy, or on the problems of air, water, and noise pollution. Some concentrate on the design of mechanical systems used in transportation, manufacturing or health care industries or by individual consumers. Some will be working, a decade from now, in fields that do not yet exist. Most will be engaged with concepts involving all four dimensions of space and time.

STUDENT ENROLLMENT AND GRADUATION DATA

The Mechanical Engineering undergraduate program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org) and is the largest undergraduate program within Lehigh's P.C. Rossin College of Engineering and Applied Science. Our enrollment and graduation figures can be found in this table (https://engineering.lehigh.edu/academics/accreditation/#meche).

PROGRAM OBJECTIVES

In harmony with the mission stated previously, the department has adopted three Program Educational Objectives (PEOs) for the undergraduate program in Mechanical Engineering.

Program graduates are expected, three to five years from graduation, to:

1. Successfully practice mechanical engineering and/or pursue advanced education, possibly towards other professions such as law, medicine, business, etc.

2. Participate at varying degrees in research and development, and other creative efforts in science, engineering, technology and/or technological entrepreneurship.

3. Engage in activities that demonstrate a commitment to professionalism and personal development and demonstrate leadership qualities.

By "successfully practice mechanical engineering" we mean:

- Advancement in careers in Mechanical, other Engineering, or careers such as health care, consulting, entrepreneurship, finance, management etc. assuming the utilization of basic engineering and science/mathematics principles and/or methodology taught in an ME program.
- Assuming increased levels of responsibility is a clear indicator of success.
- Effective communication with peers and working/leading diverse multi-disciplinary teams.
- Recognizing the global, societal and ethical contexts of their work.

In order to achieve these objectives the ME program ensures that its graduates are capable of the Student Outcomes (1-7) proposed by the accreditation organization ABET and adopted verbatim by the Lehigh University ME program. These outcomes are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Achievement of the aforementioned educational objectives is served first through a sound education in mathematics, physics, and engineering sciences; second, by exposure to the engineering process (creation, innovation, analysis, and judgment) through design courses, projects, laboratories, and a choice of technical electives that permits a degree of specialization; and third, by the development of cultural awareness through courses in humanities and social sciences. Students may also take elective courses that transcend traditional disciplinary lines, while still satisfying the requirements for mechanical engineering.

The curriculum leading toward the bachelor of science in mechanical engineering combines a broad base in mathematics, physical sciences, and the engineering sciences (mechanics of solids, materials, dynamics and fluid, thermal and electrical sciences), including laboratory. Special emphasis is placed on the practice of modern Integrated Product Development, combining state-of-the-art computer aided design and manufacturing methods in a business oriented framework. Several specific application fields are chosen toward the end of the program in the form of four or more courses elected from a wide variety of 300-level offerings. Courses in mechanical engineering and engineering mechanics are equally available.

The course requirements for a B.S. degree in mechanical engineering are listed below. In addition to required mathematics, physics, chemistry, writing and basic engineering courses, the program includes a minimum of seven courses in humanities and social sciences (see humanities/social sciences), two free electives and five approved electives. The total graduation requirement is 129 credits.

UNDERGRADUATE CURRICULUM IN MECHANICAL ENGINEERING

First Year

First Semester	Credits	Second Semester	Credits
WRT 001	3	WRT 002	3
MATH 021 (Calculus I)	4	MATH 022 (Calculus II)	4
ENGR 005 (Introduction to Engineering Practice)	2	ECO 1 or HSS elective[2]	4
Select one of the following:	5-6	Select one of the following	5-6
ENGR 010 & CHM 030[1]		ENGR 010 & CHM 030[1]	
PHY 011 & PHY 012 (Introductory Physics I and Lab)[1]		PHY 011 & PHY 012 (Introductory Physics I and Lab)[1]	
	14-15		**16-17**

Second Year

First Semester	Credits	Second Semester	Credits
ME 010 (Graphics for Engineering Design)	3	ME 104 (Thermodynamics I)	3
MECH 003 (Fundamentals of Engineering Mechanics)	3	MECH 012 (Strength of Materials)	3
ME 017 (Numerical Methods in ME)	2	MATH 205 (Linear Methods)	3
MAT 033 (Engineering Materials and Processes)	3	PHY 021 & PHY 022 (Introductory Physics II and Lab)	5
MATH 023 (Calculus III)	4	HSS Elective	3-4
	15		**17-18**

Third Year

First Semester	Credits	Second Semester	Credits
ME 021 (Mechanical Engineering Laboratory I)	1	ME 121 (Mechanical Engineering Lab II)	1
ME 231 (Fluid Mechanics)	3	ME 240 (Manufacturing)	3

MECH 102 (Dynamics)	3	ME 252 (Mechanical Elements)	3
HSS Electives	6-8	ME 211	3
Select one of the following:	3	ECE 083 (Introduction to Electrical Engineering)	3
ME 215 (Engineering Reliability)		ECE 162 (Electrical Laboratory)	1
MATH 231 (Probability & Statistics)		Select one of the following:	3
MATH 208 (Complex Variables)		ME 242 (Mechanical Engineering Systems)	
MATH 230 (Numerical Methods)		ME 245 (Engineering Vibrations)	
	16-18		**17**

Fourth Year

First Semester	Credits	Second Semester	Credits
ME 111 (Professional Development (fall only])	1	Engineering Required/ Technical-Elective courses	12-14
Engineering Required/ Technical-Elective courses	6-8	HSS & Free Electives[3]	4
ME 212	2		
HSS and Free Electives[3]	4-6		
	13-17		**16-18**

Total Credits: 124-135

Total Credits Required for Graduation 129

1

Required natural science courses, one taken fall semester and the other taken in spring

2

For ME program the preferred course in this semester is ECO 001 Principles of Economics 4 credits.

3

Total credits for HSS and free electives must be at least 19 of which at least 13 must be HSS electives (for detailed description of HSS electives see the pages of RCEAS).
Required HSS courses 10 credits: ECO 001 Principles of Economics 4 credits

WRT 001 Academic and Analytical Writing 3 credits

WRT 002 Research and Argument 3 credits

Senior year Required/Technical-Elective courses total 20 credits according to the following schedule:

ME 321	Introduction to Heat Transfer (For 3 credits; available Fall or Spring)	3
ME 207	Mechanical Engineering Laboratory III (For 2 credits; available Fall or Spring)	2
Engineering Elective A: Select one of the following for 3 credits		3
MECH 302	Advanced Dynamics (Spring Semester)	
MECH 305	Advanced Mechanics of Materials (Fall Semester)	
ME 304	Thermodynamics II (Fall Semester)	
ME 322	Gas Dynamics (Spring Semester)	
ME 331	Advanced Fluid Mechanics (Fall Semester)	
ME 343	Control Systems (Fall Semester)	
Engineering Elective B: Select one of the following for 3 credits:		3
Any ME or MECH three-hundred-level course, excluding ME 300 and ME 310		
Engineering Electives C: Select three courses for 9 credits		9
Any ME or MECH three-hundred-level course or an engineering/science/mathematics course, as approved by the depatment. ME 300 and ME 310 can count once each towards Engineering Electives C.		
Total Credits		**20**

4

Total Credits Required: 129

For the flow chart of the program please follow the link: Flow Chart **(**http://catalog.lehigh.edu/coursesprogramsandcurricula/engineeringandappliedscience/mechanicalengineeringandmechanics/BSME_Flowchart_August2023.pdf**)**

**Co-op students must take* ME 021 *sophomore year, second semester (18-19 credit hours). Co-op students will take a MATH elective (3), ME 231 (3), MECH 102(3), and a HSS elective (3-4) during the summer after the sophomore year (12-13 credit hrs.). See Co-op program for details*

Co-Op Program

To participate in the Co-op program students must rank in the top third of the engineering class after three semesters of study and attend a summer program between the sophomore and junior years. Students must see their advisor or contact the Co-op Faculty Liaison for further details.

B.S. IN ENGINEERING MECHANICS

The curriculum in engineering mechanics is designed to prepare students for careers in engineering research and development, and it is especially appropriate for students wishing to specialize in the analysis of engineering systems. In many industries and governmental laboratories there is a demand for men and women with broad training in the fundamentals of engineering in which engineering mechanics and applied mathematics play an important role.

The first two years of the curriculum is the same as that in mechanical engineering. One of the advantages of the curriculum is the flexibility it offers through 18 credits of technical and six credits of personal electives in the junior and senior years. Beyond the sophomore year there are required courses in dynamics, solid mechanics, fluid mechanics, heat transfer, principles of electrical engineering, mathematics, vibrations, and senior laboratories or projects. It is recommended that the electives be chosen either to concentrate in areas such as applied mathematics and computational mechanics, solid mechanics, engineering materials, and fluid mechanics or to obtain further depth in all areas. The academic advisor for the engineering mechanics program will provide guidance in formulating the student's goals and choosing electives.

In addition to the required and elective courses in mathematics, sciences and engineering, the B.S. degree program in engineering mechanics includes a minimum of seven courses in humanities and social sciences (see humanities/social sciences). The total graduation requirement is 127 credits.

UNDERGRADUATE CURRICULUM IN ENGINEERING MECHANICS

First Year

First Semester	Credits	Second Semester	Credits
WRT 001	3	WRT 002	3
MATH 021 (Calculus I)	4	MATH 022 (Calculus II)	4
ENGR 005 (Introduction to Engineering Practice)	2	ECO 1 or HSS elective[2]	3-4
Select one of the following:	5-6	Select one of the following	5-6
ENGR 010 & CHM 030[1]	6	ENGR 010 & CHM 030[1]	6

PHY 011 & PHY 012 (Introductory Physics I and Lab)[1]	5	PHY 011 & PHY 012 (Introductory Physics I and Lab)[1]	5
	14-15		**15-17**

Second Year

First Semester	Credits	Second Semester	Credits
ME 010 (Graphics for Engineering Design)	3	ME 104 (Thermodynamics I)	3
MECH 003 (Fundamentals of Engineering Mechanics)	3	MECH 012 (Strength of Materials)	3
ME 017 (Numerical Methods in ME)	2	PHY 021 & PHY 022 (Introductory Physics II and Lab)	5
MAT 033 (Engineering Materials and Processes)	3	MATH 205 (Linear Methods)	3
MATH 023 (Calculus III)	4	Elective	3-4
Elective	2-3		
	17-18		**17-18**

Third Year

First Semester	Credits	Second Semester	Credits
ME 021 (Mechanical Engineering Laboratory I)	1	ME 121 (Mechanical Engineering Lab II)	1
ME 231 (Fluid Mechanics)	3	ME 240 (Manufacturing)	3
MECH 102 (Dynamics)	3	MATH 208 (Complex Variables)	3
MATH 230 (Numerical Methods)	3	ECE 083 (Introduction to Electrical Engineering)	3
Electives	6-8	ECE 162 (Electrical Laboratory)	1
		Electives	3-4
		Select one of the following:	3
		ME 242 (Mechanical Engineering Systems)	
		ME 245 (Engineering Vibrations)	
	13-15		**17-18**

Fourth Year

First Semester	Credits	Second Semester	Credits
ME 111 (Professional Development [fall only])	1	Engineering Required/ Technical-Elective courses	9-11
Engineering Required/ Technical-Elective courses	9-11	HSS and Free Electives[3]	4
HSS and Free Electives[3]	4	undefined	
	14-16		**13-15**

Total Credits: 120-132

TOTAL CREDITS REQUIRED FOR GRADUATION 127

1

Required natural science courses, one taken fall semester and the other taken in spring

2

For ME/MECH programs the preferred course in this semester is ECO 001 Principles of Economics) 4 credits.

3

Total credits for HSS and free electives must be at least 19 of which at least 13 must be HSS electives (for detailed description of HSS electives see the pages of RCEAS).
Required HSS courses 10 credits: ECO 001 Principles of Economics 4 credits

WRT 001 Academic and Analytical Writing 3 credits

WRT 002 Research and Argument 3 credits

Senior year Required/Technical-Elective courses total 23 credits according to the following schedule:

ME 321	Introduction to Heat Transfer (For 3 credits; available Fall or Spring)	3
ME 207	Mechanical Engineering Laboratory III (For 2 credits; available Fall or Spring)	2
Engineering Elective A: Select two of the following for 6 credits		6
MECH 302	Advanced Dynamics (Spring Semester)	
MECH 305	Advanced Mechanics of Materials (Fall Semester)	
ME 304	Thermodynamics II (Fall Semester)	
ME 322	Gas Dynamics (Spring Semester)	
ME 331	Advanced Fluid Mechanics (Fall Semester)	
ME 343	Control Systems (Fall Semester)	
Engineering Elective B: Select 4 courses for 12 credits		12
From any ME or MECH three-hundred-level course, excluding ME 300 and ME 310		
Total Credits		**23**

4

Total Credits Required: 127

**Co-op students must take ME 021 sophomore year, second semester (18-19 credit hours). Co-op students will take ME 231 (3),MECH 102(3), and two HSS electives (6-8) during the summer after the sophomore year (12-14 credit hours). See Co-op program for details.*

Typical recommended options:

Applied Mathematics and Computational Mechanics		
MECH 305	Advanced Mechanics of Materials	3
MECH 312	Finite Element Analysis	3
MATH 309	Probability with Applications and Simulations	3
MATH 322	Methods of Applied Analysis I	3
MATH 323	Methods of Applied Analysis II	3
Solid Mechanics		
MECH 305	Advanced Mechanics of Materials	3
MECH 307	Mechanics of Continua	3
MECH 312	Finite Element Analysis	3
MECH 313	Fracture Mechanics	3
MATH 322	Methods of Applied Analysis I	3
Engineering Materials		
MECH 305	Advanced Mechanics of Materials	3
MECH 313	Fracture Mechanics	3
MAT 218	Mechanical Behavior of Macro/ Nanoscale Materials	3
PHY 031	Introduction to Modern Physics	3
PHY 363	Physics of Solids	3
Fluid Mechanics		
ME 331	Advanced Fluid Mechanics	3
ME 322	Gas Dynamics	3

MECH 326	Aerodynamics	3
MATH 322	Methods of Applied Analysis I	3

MINOR IN AEROSPACE ENGINEERING

The minor in aerospace engineering provides a foundation for students who intend to pursue a career in the aerospace industry. This minor will also provide sufficient technical background in aerospace studies for undergraduates who plan to enter graduate programs in this field. The minor requires a minimum of 15 credits from the following course selection:

Required Courses		
ME 255	Introduction to Aerospace Engineering	3
MECH 326	Aerodynamics	3
MECH 328	Fundamentals of Aircraft Design	3
Elective Courses		
Select two of the following:		6
ME 309	Composite Materials	
ME 322	Gas Dynamics	
ME 331	Advanced Fluid Mechanics	
ME 333	Propulsion Systems	
ME 343	Control Systems	
ME 348	Computer-Aided Design	
ME 354	Automatic Control of Aerospace Vehicles	
ME 355	Spacecraft Systems Engineering	
ME 356	Astrodynamics	
MECH 302	Advanced Dynamics	
MECH 305	Advanced Mechanics of Materials	
MECH 312	Finite Element Analysis	
Total Credits		**15**

MINOR IN ENERGY ENGINEERING

The minor in energy engineering touches upon the technologies associated with the transformation and use of energy in various forms. Since every sector of engineering and the economy require energies of one form or another, the courses included in this minor program will permit student exposure to fossil, nuclear and renewable energy technologies. The mechanical engineering curriculum provides the fundamental knowledge in thermodynamics, fluid mechanics and other related areas leading up to the courses for the energy engineering minor. The courses offer a wide variety of topics including fundamental, analytical and design aspects of energy conservation as well as various forms of energy used in power generation, transportation and industry.

The minor in energy engineering requires a minimum of 15 credits, which must be taken from MEM offerings. The minor in energy is primarily intended for ME Majors but students with other majors, particularly Chemical engineering will be able to take some or all the related courses. Four courses are required with some degree of choice and an additional course must be selected from a broader set.

Required course		
ME 304	Thermodynamics II	3
Elective Energy Courses		
Select at least three of the following:		9
ME 360	Nuclear Reactor Engineering	
ME 362	Nuclear Fusion and Radiation Protection	
ME 364	Renewable Energy	
ME 366	Power Generation Technologies	
Additional Electives		
Select one of the following:		3
CHE 373	Fundamentals of Air Pollution	
CHE/ME 376	Energy: Issues & Technology	
CHE 386	Process Control	
ME 322	Gas Dynamics	
ME 331	Advanced Fluid Mechanics	
ME 343	Control Systems	
Other Energy related 300 level courses with the approval of the ME Dept. Chair.		
Total Credits		**15**

MINOR IN MECHANICS OF MATERIALS

The minor in mechanics of materials provides a view of mechanical strength and behavior of materials based on understanding a few basic concepts and using simplified material models. Courses selected for the minor emphasize concepts such as superposition of loadings; relation between external loads and internal stresses; factor of safety; safe design based on allowable stress or allowable loads; allowable deformation; and reliability of structures. Courses offer a wide variety of topics including analytical and numerical methods for solving mechanics problems; manufacturing and polymer processing.

The mechanics of materials minor requires a minimum of 15 credits, which must be taken from MEM offerings. Two courses are required; and three additional electives must be selected. The minor is not available for students having a major in the Department of Mechanical Engineering and Mechanics.

Required courses		
MECH 003	Fundamentals of Engineering Mechanics	3
MECH 012	Strength of Materials	3
Electives		
Select three of the following:		9
ME 010	Graphics for Engineering Design	
ME 215	Engineering Reliability	
ME 240	Manufacturing	
ME 252	Mechanical Elements	
ME 385	Polymer Product Manufacturing	
MECH 102	Dynamics	
MECH 305	Advanced Mechanics of Materials	
MECH 312	Finite Element Analysis	
MECH 313	Fracture Mechanics	
Total Credits		**15**

GRADUATE PROGRAMS

The Department offers programs of study leading to the degrees of Master of Science and Doctor of Philosophy in Mechanical Engineering.

The mission of the Department of Mechanical Engineering & Mechanics is to provide quality education and training to undergraduate and graduate students, develop new knowledge and engineering methodology through research, and serve industry and society at large.

Consistent with the above mission statement, the education components of the graduate programs strive to:

- Educate graduate students to a level of mechanical engineering higher than that of the high-quality undergraduate program. This level is mainly defined by the content and scope of the core courses offered.
- Enable students to engage in advanced study and research with scholars on various topics relating to mechanical engineering.
- Familiarize students with issues relating to support, funding and presentation of research results and products.

In addition to the foregoing objectives, the presence of graduate programs and students has additional, beneficial effects on the goals of the Department and the University, such as:

- Interaction of undergraduate students with a diverse body of highly motivated learners.
- Increase in the efficiency of basic and applied research.
- Continuous incentive for improvement in the methods and material taught to graduate and undergraduate students.

Subject to approval, courses from other interdisciplinary curricula in engineering, mathematics, sciences and more may be included in the degree program.

MASTERS DEGREE PROGRAM

The Department of Mechanical Engineering & Mechanics offers a Master of Science degree that requires 30 credit hours of graduate work. Audit courses may not be used towards the degree. Master's degrees must satisfy the University course distribution requirements, as outlined in the P.C. Rossin College of Engineering & Applied Science (RCEAS) Graduate Student Handbook (https://engineering.lehigh.edu/academics/graduate/student-handbook/). The minimum program for all Masters degrees includes:

- Not less than 24 credits of 300- and 400-level coursework and at least 18 hours at the 400-level. Thesis credits count as part of the 400-level requirement.
- Not less than 18 credit hours in Mechanical Engineering & Mechanics.
- Not less than 15 credit hours of 400-level coursework in Mechanical Engineering & Mechanics.
- No course below the 300-level in Mechanical Engineering & Mechanics can be used towards the degree; however, two courses (6 credits) outside of the department may be taken at the 200-level.

Master of Science in Mechanical Engineering

Required Core Course in Engineering Mathematics:		3
ME 452	Mathematical Methods In Engineering I	
Required Core Course in MEM (choose two courses):		6
ME 402	Advanced Manufacturing Science	
ME 413	Numerical Methods in Mechanical Engineering	
ME 423	Heat and Mass Transfer	
ME 430	Advanced Fluid Mechanics	
ME 433	Linear Systems and Control	
ME 453	Mathematical Methods in Engineering II	
MECH 408	Introduction to Elasticity	
MECH 425	Analytical Methods in Dynamics and Vibrations	
MEM Electives: Three courses (9 credits) selected from ME and MECH courses at the 300 and 400 level, excluding ME 460 and ME 490. Only one ME or MECH course in this group may be at the 300 level.		9
Free Electives: Four courses (12 credits) at the 300 and 400 selected level from ME and MECH courses or from another department. Up to two courses from another department may be taken at the 200 level.		12

In total, at least 18 credits must be take at the 400 level.

Doctor of Philosophy in Mechanical Engineering

The Ph.D. program in Mechanical Engineering & Mechanics requires innovative research in collaboration with one or more faculty members, along with the completion of 72 credit hours beyond the bachelor's degree (if graduate study is carried out entirely at Lehigh University), or 48 beyond the master's degree (obtained at another university). The first stage of Ph.D. candidacy is attained by achieving a minimum GPA of 3.35 in five core courses (see core course requirements in the table below). Ph.D. students must also take ME 453, which can either be taken as part of the five core course requirement or taken as an additional course. Beyond the five core courses, students must complete a minimum of three technical electives, to be selected in consultation with the student's advisor and doctoral committee. Ph.D. students who previously completed graduate courses at another institution may petition through a Department process for evaluation of eligibility for waiver of course requirements. The second stage of candidacy involves completion of a General Examination, which is based on an assessment of a research topic, formulation of a research proposal, and completion of an associated oral examination. Formal admission to candidacy for the Ph.D. is granted upon submittal of a proposal for the dissertation research and recommendation of the doctoral committee followed by approval of the P.C. Rossin College of Engineering & Applied Science. To complete the Ph.D. degree, the student must present and defend a dissertation before the doctoral committee.

Required Core Courses in Engineering Mathematics (two courses):		6
ME 452	Mathematical Methods In Engineering I	
ME 413	Numerical Methods in Mechanical Engineering	
or ME 453	Mathematical Methods in Engineering II	
Required Core Courses in MEM (choose three courses):		9
ME 402	Advanced Manufacturing Science	
ME 423	Heat and Mass Transfer	
ME 430	Advanced Fluid Mechanics	
ME 433	Linear Systems and Control	
MECH 408	Introduction to Elasticity	
MECH 425	Analytical Methods in Dynamics and Vibrations	
Technical Electives: Three courses (9 credits) selected from ME and MECH courses at the 400 level, or at 400 level from another department.		9
Additional Requirements:		3
ME 440	General Examination	

Course requirements for the PhD Degree

A student pursuing a PhD after completing an MS/MSc degree from another institution may petition for a waiver of some coursework requirements. Petitions for waiver of coursework requirements may include up to one course equivalent to a core course in engineering mathematics and one course equivalent to a core course in MEM. In addition, the student may petition for a waiver of up to three courses taken elsewhere for technical electives. All courses being used to waive coursework requirements must be approved by the instructor of the corresponding Lehigh course. The student must submit a petition with the following: (a) a syllabus in English or a sufficiently detailed print-out of the course catalog from the MS institution; (b) a letter of support or a signed petition from the PhD advisor; and (c) any additional documentation beyond the syllabus as requested by the instructor.

General Examination for the PhD Degree

Students must achieve the minimum GPA of 3.35 in the first five core courses to be eligible to take the General Examination. Students taking the General Examination must register for three credits of ME 440. Detailed procedures related to administration of the General Exam can be found in the MEM Graduate Student (https://engineering.lehigh.edu/sites/engineering.lehigh.edu/files/MEM%20Grad%20Program%20Guidelines%20NEW2024%20v01.pdf)Guidelines. (https://engineering.lehigh.edu/sites/engineering.lehigh.edu/files/MEM%20Grad%20Program%20Guidelines%20NEW2024%20v01.pdf)

Proposal for the PhD Degree

To formally become a PhD candidate at the University level, the student must prepare a proposal for the dissertation research. This proposal includes a course plan for all courses during the PhD program. The proposal is presented to, and approved by, the PhD Committee. The student then submits the proposal signed by the Committee members for approval by the college.

Additional Requirements for the PhD Degree

Two or more manuscripts must be submitted for peer-reviewed journal publication prior to the dissertation defense. At least one of these manuscripts must have undergone a first external review process. A student may petition, with detailed justification, to account for unusual preparation efforts, for example, the submittal of a single manuscript to an extraordinarily competitive journal, an unreasonably long review

time for a submitted manuscript, or alternate products consistent with the indicators of scholarship in the student's area of research.

The minimum number of department seminars must have been attended by the student during the course of the PhD program.

Complete information on all requirements and procedures for the PhD in Mechanical Engineering can be found in the MEM Graduate Student Handbook.

RESEARCH FACILITIES

The Department has a wide range of faculty-led research labs with facilities for experimental research. These resources include laser diagnostics for experiments in fluid mechanics, two wind tunnels, and three large-scale water channels. Laboratories for multidisciplinary studies of phenomena in solid mechanics include comprehensive mechanical testing equipment and world-class microscopy facilities. Extensively equipped interdepartmental robotics, controls, and manufacturing laboratories are also available.

Computational resources for high-end modeling and simulation include Department-maintained computer labs and computational workstations in faculty research groups. The University supports high-performance computing (HPC) through two compute clusters that provide over 17 million core-hours for research on campus. The Department and University also provide access to a wide range of software (https://software.lehigh.edu/) packages for academic and research use. Access to journals and databases is provided through Library & Technology Services (https://lts.lehigh.edu/).

RECENT RESEARCH ACTIVITIES

Information about recent MEM faculty and student research accomplishments can be found on our departmental news (https://engineering.lehigh.edu/meche/news/) and research (https://engineering.lehigh.edu/meche/research/) web pages.

Mechanical Engineering Courses

ME 010 Graphics for Engineering Design 0,3 Credits
Graphical description of mechanical engineering design for visualization and communication by freehand sketching, production drawings, and 3D solid geometric representations. Introduction to creation, storage, and manipulation of such graphical descriptions through an integrated design project using state-of-the art, commercially available computer-aided engineering software. Lectures and laboratory. (ES 1), (ED 2).

ME 017 Numerical Methods in Mechanical Engineering 2 Credits
Numerical methods applied to mechanical engineering problems. Techniques for interpolation, curve fitting, plotting of numerical data, etc. Numerical techniques for solving algebraic and differential equations. Computational platforms to be used include MATLAB.
Prerequisites: ENGR 010

ME 021 Mechanical Engineering Laboratory I 0,1 Credits
Experimental methods in mechanical engineering and mechanics. Analysis of experimental error and error propagation. Introduction to elementary instrumentation. Introduction to digital data acquisition.
Prerequisites: MECH 012
Can be taken Concurrently: MECH 012

ME 050 Supplemental Topics in Mechanical Engineering 1-2 Credits
Completion of material for Mechanical Engineering courses transferred from other institutions. Student wil be scheduled for that part of Mechanical Engineering that is required for completion of missing material. Subject matter and credit hours to be determined by department chair for each student.

ME 104 Thermodynamics I 0,3 Credits
Basic concepts and principles of thermodynamics with emphasis on simple compressible substances. First and second law development, energy equations, reversibility, entropy and efficiency. Properties of pure substances and thermodynamic cycles.
Prerequisites: (MATH 033 or MATH 023) and (PHY 011)
Can be taken Concurrently: MATH 033, MATH 023, PHY 011

ME 111 Professional Development 1 Credit
Examination of ethical and professional choices facing mechanical engineers. Written and oral communications. Must have senior standing in Mechanical Engineering and Mechanics.

ME 121 Mechanical Engineering Laboratory II 0,1 Credits
A continuation of ME 21 including use of transducers, advanced instrumentation, and data acquisition. Emphasis on experimental exercises that illustrate, and/or introduce material from thermodynamics, and fluid mechanics. Includes proposal writing and interpretation of results.
Prerequisites: ME 021 and ME 104 and ME 231
Can be taken Concurrently: ME 231

ME 141 General Aviation Technology and Operations 2 Credits
A Federal Aviation Administration (FAA) certified course for students interested in understanding the engineering and operational aspects of the general aviation industry, including aerodynamics, aircraft systems and performance, weather, navigation, flight procedures, regulations, maneuvers, and the physiology of flight. Successful completion of the course will fulfill the FAA requirement for the ground school component of a private pilot certification.

ME 142 Instrument Ground Training 2 Credits
A Federal Aviation Administration (FAA) certified course for students interested in pursuing an instrument rating from the FAA. Successful completion of the course will fulfill the FAA requirement for the ground school component of an instrument rating.
Prerequisites: ME 141

ME 205 Application of Differential Equations in Mechanical Engineering 3 Credits
Solution and application of differential equations in engineering, including linear methods underpinning solution methodologies. Applications of differential equations include: Newton's law of cooling; linear and nonlinear dynamical systems; mechanical vibrations; beam theory; column buckling; heat/diffusion, wave, and Laplace's equations. This course counts as a fifth mathematics course or an Engineering C elective for MEM students.
Prerequisites: MATH 022

ME 207 Mechanical Engineering Laboratory III 2 Credits
Formulation of laboratory experiments through open-ended planning, including decision criteria for laboratory techniques and approaches. Execution of experiments based on individual plans, followed by assessment of experimental results.
Prerequisites: ME 121

ME 211 (BIOC 211, BIOE 211, ENGR 211, MAT 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
Prerequisites: ME 104 and ME 231 and ME 240 and MECH 102
Can be taken Concurrently: ME 231, ME 240, MECH 102

ME 212 (BIOC 212, BIOE 212, ENGR 212, MAT 212) Capstone Design Project II 2 Credits
Students continue developing their solutions from ME 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
Prerequisites: ME 211

ME 215 Engineering Reliability 3 Credits
Applications of reliability methods to engineering problems. Modeling and analysis of engineered components and systems subjected to environmental and loading conditions. Modeling content encompasses mechanistically based probability and experientially based statistical approaches. Concepts needed for design with uncertainty are developed. Principles are illustrated through case studies and projects. Engineering applications software will be extensively utilized for the projects.
Prerequisites: (MATH 023 or MATH 033) and MECH 012
Can be taken Concurrently: MECH 012

ME 231 Fluid Mechanics 3 Credits
Kinematics of fluid flow and similarity concepts. Equations of incompressible fluid flow with inviscid and viscous applications. Turbulence. One-dimensional compressible flow, shock waves. Boundary layers, separation, wakes and drag.
Prerequisites: (MATH 205 or ME 205) and ME 104

ME 240 Manufacturing 0,3 Credits
Analytical and technological base for several manufacturing processes and common engineering materials. Processes include metal cutting, metal deformation, injection molding, thermoforming, and composites. Process planning, computer-aided manufacturing, manufacturing system engineering, and quality measurements. Design project. Weekly laboratory.
Prerequisites: ME 010 and MECH 012

ME 242 Mechanical Engineering Systems 3 Credits
The modeling and analysis of mechanical, fluid, electrical and hybrid systems, with emphasis on lumped models and dynamic behavior, including vibrations. Source-load synthesis. Analysis in temporal and frequency domains. Computer simulation of nonlinear models, and computer implementation of the superposition property of linear models.
Prerequisites: MECH 102 and MATH 205

ME 245 Engineering Vibrations 0,3 Credits
Physical modeling of vibrating systems. Free and forced single and multiple degree of freedom systems. Computer simulations. Engineering applications.
Prerequisites: MECH 102 and ME 017 and (MATH 205 or ME 205)

ME 252 Mechanical Elements 3 Credits
Methods for the analysis and design of machine elements such as springs, gears, clutches, brakes, and bearings. Motion analysis of cams and selected mechanisms. Projects requiring the design of simple mechanisms of mechanical sub-assemblies.
Prerequisites: MECH 012 and ME 010 and MECH 102

ME 255 Introduction to Aerospace Engineering 3 Credits
An introductory course in the core engineering principles used in the aerospace industry: aerodynamics, controls, propulsion, and structures. The course is designed for any engineering student who may intend to work in the aerospace industry and develops a basic understanding of the technologies used in the design and operation of today's aircraft, rockets, and spacecraft.
Prerequisites: ME 104

ME 299 Special Topics In Mechanical Engineering 1-4 Credits
Repeat Status: Course may be repeated.

ME 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

ME 304 Thermodynamics II 3 Credits
Availability and Second Law Analysis. Design of gas and vapor power cycles, and refrigeration systems. Generalized property relations for gases and gas-vapor. Combustion and chemical equilibrium. Design of engineering systems and processes incorporating thermodynamic concepts and analysis.
Prerequisites: ME 104

ME 309 (MAT 309) Composite Materials 3 Credits
Principles and technology of composite materials. Processing, properties, and structural applications of composites, with emphasis on fiber-reinforced polymers.
Prerequisites: MECH 003 and MAT 033

ME 310 (TE 310) Directed Study 1-3 Credits
Project work on any aspect of engineering, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the projects may be provided by faculty from several departments and could include interaction with outside consultants and local communities and industries. Consent of department required.
Repeat Status: Course may be repeated.

ME 312 Analysis and Synthesis Of Mechanisms 3 Credits
Types of motion. Degrees of freedom of motion. Position, velocity and acceleration analysis of linkage mechanisms. Systematic approach to the design of linkage mechanisms. Motion generation, path synthesis and function synthesis. Structural synthesis of planar and spatial mechanisms. Static force analysis of mechanisms using virtual work.
Prerequisites: MATH 205 and MECH 102

ME 314 (MAT 314) Metal Forming Processes 3 Credits
Mechanical metallurgy and mechanics of metal forming processes. Yield criteria. Workability. Friction and lubrication. Engineering analysis of forging, extrusion, wire and tube drawing, rolling, sheet forming and other processes. Recent developments in metal forming.

ME 315 (BIOE 315) Bioengineering Statistics 3 Credits
Probability and statistics applied to bioengineering problems focusing on modeling and data analysis. Types of data, types of distributions, parametric and nonparametric analyses, goodness-of-fit, regression, power analysis, and multivariate analysis, life models, simulation, cluster analysis, and Bayesian statistics. Projects and case studies.
Prerequisites: MATH 231

ME 316 (BIOE 316) Introduction to Force Spectroscopy 3 Credits
Fundamentals of major force spectroscopy methods, including atomic force microscopy, optical tweezers, and magnetic tweezers. Principles of force measurement, force calibration, and signal and noise. Applications to the mechanical properties of biomaterials, such as polymer elasticity, protein folding, nanoindentation, and structural transitions in macromolecules. Closed to students who have taken BIOE 416.
Prerequisites: MECH 003

ME 321 Introduction to Heat Transfer 3 Credits
Analytical and numerical solutions to steady and transient one-and two-dimensional conduction problems. Forced and natural convection in internal and external flows. Thermal radiation. Thermal design of engineering processes and systems.
Prerequisites: ME 104 and ME 231

ME 322 Gas Dynamics 3 Credits
Flow equations for compressible fluids; thermodynamic properties of gases. Normal shock waves. Steady one-dimensional flows with heat addition and friction. Oblique shock waves. Expansion waves. Nozzle flows. Shock tubes; performance calculations and design. Supersonic wind tunnels; diffuser design. Real gas effects.
Prerequisites: ME 231 and ME 104

ME 323 Reciprocating and Centrifugal Engines 0,3 Credits
Thermal analysis and design of internal combustion engines (conventional and unconventional), gas turbine engines, air breathing jet engines, and rockets. Components such as jet nozzles, compressors, turbines, and combustion chambers are chosen to exemplify the theory and development of different types of components. Both ideal fluid and real fluid approaches are considered.
Prerequisites: ME 104

ME 325 Ethical Issues for Mechanical Engineers 3 Credits
Introduction to Engineering Ethics familiarizes students with the methods used for developing ethical approaches in engineering practice. Through reading, writing and discussion this course takes a 'case-study' approach. Cases are historical and contemporary and may include: Challenger, Chernobyl, Bhopal, Ford Pinto, Essure as well as more general areas as: Genetic Technology, Energy, AI, Medical Technology and the newly emerging study of Design Ethics. Each student will research and prepare a major presentation. Senior standing and/or instructor permission required.
Prerequisites: ME 111

ME 331 Advanced Fluid Mechanics 3 Credits
Kinematics of fluid flow. Conservation equations for inviscid and viscous flows; integral forms of equations. Two-dimensional potential flow theory of incompressible fluids with applications. Boundary layers. Introduction to free shear layer and boundary layer stability and structure of turbulence. Transition from laminar to turbulent boundary layers. Separation of flow. Steady and unsteady stall. Secondary flows. Hydrodynamic lubrication. Measurement techniques.
Prerequisites: ME 231

ME 333 Propulsion Systems 3 Credits
Review of jet and rocket engine technologies. Jet and rocket engine thermodynamic and aerodynamic principles. Performance of turbojet, turbofan, and turboprop jet engines. Rocket engines include liquid, cryogenic, solid, and electric propulsion.
Prerequisites: ME 104 and MECH 326
Can be taken Concurrently: MECH 326

ME 340 Advanced Mechanical Design 3 Credits
Probabilistic design of mechanical components and systems. Reliability functions, hazard models and product life prediction. Theoretical stress-strength-time models. Static and dynamic reliability models. Optimum design of mechanical systems for reliability objectives or constraints.

ME 341 Mechanical Systems 3 Credits
Advanced topics in mechanical systems design. Kinematics and dynamics of planar machinery. Shock and vibration control in machine elements. Balancing of rotating and reciprocating machines. Design projects using commercial computer-aided-engineering software for the design and evaluation of typical machine systems.
Prerequisites: ME 252

ME 342 Dynamics of Engineering Systems 3 Credits
Dynamic analysis of mechanical, electromechanical, fluid and hybrid engineering systems with emphasis on the modeling process. Lumped and distributed-parameter models. Use of computer tools for modeling, design and simulation. Design projects.
Prerequisites: ME 242

ME 343 Control Systems 3 Credits
A comprehensive course in classical and modern linear control systems. Includes root locus, frequency response, state space, and digital control techniques with extensive use of computational methods. A design project provides experience with practical design issues and tradeoffs.
Prerequisites: ME 242 or ECE 125 or ME 245

ME 348 Computer-Aided Design 3 Credits
Impact of computer-aided engineering tools on mechanical design and analysis. Part geometry modeling and assembly modeling using solid representations. Analysis for mass properties, interference, kinematics, displacements, stresses and system dynamics by using state-of-the-art commercially available computer-aided-engineering software. Integrated design projects.
Prerequisites: ME 010 and MECH 012 and MECH 102 and MATH 205

ME 350 Special Topics 1-5 Credits
A study of some field of mechanical engineering not covered elsewhere. Consent of department chair required.
Repeat Status: Course may be repeated.

ME 354 Automatic Control of Aerospace Vehicles 3 Credits
The forces and moments acting on rigid aircraft are developed from basic aerodynamics and used to determine the equations of motion and the resulting dynamic models. Analysis from these dynamic models supports the design of flight control, guidance, and autopilot systems. Modern control methods for missiles and spacecraft are also included. Undergraduate course assumes rigid airplane structures, while the graduate course develops the effects of flexible structures.
Prerequisites: MECH 326 and ME 343

ME 355 Spacecraft Systems Engineering 3 Credits
Systems engineering approach to design, integration, testing, and operations of spacecraft for various missions. Technologies currently used in modern spacecraft bus and payload systems, astrodynamics, launch systems, life-cycle costs, and operational issues. Team works to design a spacecraft that meets a specific set of mission requirements.
Prerequisites: ME 255

ME 356 Astrodynamics 3 Credits
Kepler's Laws are discussed and proven from basic mechanics, then used to determine the equations of motion for a satellite. Subsequent topics include various kinds of orbits in use today, orbit determination, orbital maneuvers, and rendezvous. Interplanetary trajectories, satellite attitude dynamics, rocket vehicles, and orbital perturbations are also discussed.
Prerequisites: MECH 102

ME 360 Nuclear Reactor Engineering 3 Credits
A consideration of the engineering problems related to nuclear reactor design and operation. Topics include fundamental properties of atomic and nuclear radiation, reactor fuels and materials, reactor design and operation, thermal aspects, safety and shielding, instrumentation and control. Course includes several design projects stressing the major topics in the course. Must have senior standing in engineering or physical science.

ME 362 Nuclear Fusion and Radiation Protection 3 Credits
Structure of the nucleus. Quantum theory. Nuclear energy release: Fission vs. Fusion. Plasma for fusion. Power balances in fusion plasmas. Magnetic and inertial confinement fusion concepts. Magnetic equilibrium configurations and limitations. The Tokamak. Emerging and alternative concepts. Fusion reactor economics. Radiation sources and Radioactive decay. Interactions of radiation with matter, detectors and protection from radiation. Energy deposition and dose calculations. Applications in dosimetry, imaging and spectroscopy. Must have senior standing in engineering or physical science.

ME 364 Renewable Energy 3 Credits
Fundamentals and design aspects of Renewable Energy (RE) technologies; biofuels, hydropower, solar photovoltaic, solar thermal, wind, geothermal energies. Details and difficulties in implementing RE. Senior standing in Engineering. Credit not given for both ME 364 and ME 464.
Prerequisites: ME 104 and ME 231

ME 366 Power Generation Technologies 3 Credits
The energy matrix is changing due to economic, environmental, and political pressure, requiring a transition to become more efficient, carbon-neutral, resilient, and competitive. This course looks at the design and performance of conventional (coal and natural gas) power generation systems, including thermal cycles, power plant efficiency, technologies for environmental compliance, carbon capture and sequestration, plant flexibilization and energy storage, and advanced plant data analytics. Must have junior standing in engineering or physical science.

ME 368 Fundamentals of Energy Efficiency Practicum 3 Credits
Studies of the plant operation and energy usage. Students work with the Lehigh Industrial Assessment Center to do technical and economic feasibility studies of optimizing energy consumption. Industrial experience. Fundamentals of best practices to save energy, reduce waste, and increase productivity. Consent of instructor required.
Prerequisites: ME 104 and ME 231

ME 373 Mechatronics 3 Credits
Synergistic integration of mechanical engineering with electronics and intelligent computer control in designing and manufacturing machines, products and processes; semiconductor electronics, analog signal processing, with op amps, digital circuits, Boolean algebra, logic network designs, Karnaugh map, flip-flops and applications, data acquisition, A/D and D/A, interfacing to personal computers, sensors and actuators, microcontroller programming and interfacing.

ME 374 Mechatronics Laboratory 3 Credits
Experiments and applications utilizing combinations of mechanical, electrical, and microprocessor components. Theory and application of electronic and electromechanical equipment, operation and control of mechatronic systems. Projects integrating mechanical, electronic and microcontrollers.

ME 376 (CHE 376) Energy: Issues & Technology 3 Credits
Energy usage and supply, fossil fuel technologies, renewable energy alternatives and environmental impacts. The scope will be broad to give some perspective of the problems, but in-depth technical analysis of many aspects will also be developed.
Prerequisites: CHE 210 or ME 104 or CHM 342 or MAT 205

ME 385 Polymer Product Manufacturing 3 Credits
Polymer processes such as injection molding through a combination of theory development, practical analysis, and utilization of commercial software. Polymer chemistry and structure, material rheological behavior, processing kinetics, molecular orientation development, process simulation software development, manufacturing defects, manufacturing window establishment, manufacturing process design, manufacturing process optimization. Must have senior level standing in engineering or science. Credit not given for both ME 385 and ME 485.

ME 387 (CHE 387, ECE 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane; root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Liapunov stability state feedback control (two lectures and one laboratory per week).
Prerequisites: CHE 386 or ECE 212 or ME 343

ME 388 Honors Project for Eckardt Scholar 1-4 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors.Transcript will identify department in which project was completed.
Repeat Status: Course may be repeated.

ME 389 (CHE 389, ECE 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state-of-the-art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on design of feedback controllers and comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary.
Prerequisites: CHE 386 or ECE 212 or ME 343

ME 401 (MSE 401) Integrated Product Development 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. The course uses case studies and team projects. ME 402.

ME 402 (MAT 402) Advanced Manufacturing Science 3 Credits
The course focuses on the fundamental science-base underlying manufacturing processes, and applying that science base to develop knowledge and tools suitable for industrial utilization. Selected manufacturing processes representing the general classes of material removal, material deformation, material phase change, material flow, and material joining are addressed. Students create computer-based process simulation tools independently as well as utilize leading commercial process simulation packages. Laboratory experiences are included throughout the course.

ME 413 Numerical Methods in Mechanical Engineering 3 Credits
Zeros of functions, difference tables, interpolation, integration, differentiation. Divided differences, numerical solution of ordinary differential equations of the boundary and initial value type. Eigen problems. Curve fitting, matrix manipulation and solution of linear algebraic equations. Partial differential equations of the hyperbolic, elliptic and parabolic type. Application to problems in mechanical engineering.

ME 420 Advanced Thermodynamics 3 Credits
Critical review of thermodynamics systems. Criteria for equilibrium. Applications to electromagnetic systems. Statistical thermodynamics. Irreversible thermodynamics. Thermoelectric phenomena.

ME 421 Topics in Thermodynamics 3 Credits
Emphasis on theoretical and experimental treatment of combustion processes including dissociation, flame temperature calculations, diffusion flames, stability and propagation; related problems in compressible flow involving one-dimensional, oblique shock waves and detonation waves. Methods of measurement and instrumentation.

ME 423 Heat and Mass Transfer 3 Credits
This course is a first graduate course in the basic concepts of heat and mass transfer, providing a broad coverage of key areas in diffusion, conduction, convection, heat and mass transfer, and radiation. Topics covered include: the conservation equations, steady and transient diffusion and conduction, periodic diffusion, melting and solidification problems, numerical methods, turbulent convection, transpiration and film cooling, free convection, heat transfer with phase change, heat exchanges, radiation, mixed mode heat and mass transfer.

ME 424 Unsteady and Turbulent Flow 3 Credits
Stability of laminar flow; transition to turbulence. Navier-Stokes equations with turbulence. Bounded turbulent shear flows; free shear flows; statistical description of turbulence.

ME 430 Advanced Fluid Mechanics 3 Credits
This course is a first graduate course in incompressible fluid mechanics, providing a broad coverage of key areas of viscous and inviscid fluid mechanics. Topics covered include: Flow kinematics, differential equations of motion, viscous and inviscid solutions, vorticity dynamics and circulation, vorticity equation, circulation theorems, potential flow behavior, irrotational and rotational flows, simple boundary layer flows and solutions, and real fluid flows and consequences.

ME 431 Advanced Gas Dynamics 3 Credits
Method of characteristics. Unsteady continuous flow. Unsteady flows with discontinuities. Shock tubes. Detonation waves. Two-dimensional and axisymmetric supersonic flows. Momentum and energy equation of compressible viscous fluids.

ME 433 (CHE 433, ECE 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations, Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability, Canonical forms, minimal realizations, introduction to optimal control theory, Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers.

ME 434 (CHE 434, ECE 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special attention is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures.
Prerequisites: CHE 433 or ME 433 or ECE 433

ME 436 (CHE 436, ECE 436) Systems Identification 3 Credits
The determination of model parameters from time-history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant-imbedding techniques for nonlinear system parameter identification included.

ME 440 General Examination 3 Credits
A critical assessment and definition of major unresolved issues for an assigned research topic during the first half of the semester, followed by formulation of a research proposal in accord with the format of a federal funding agency during the second half of the semester. In addition to the written proposal, the student gives a presentation to the Doctoral Committee, followed by extensive discussion. Grade assigned by the committee; minimum grade of B+ required. Instructor (doctoral student adviser) approval required.

ME 450 Special Topics 3 Credits
An intensive study of some field of mechanical engineering not covered in more general courses.
Repeat Status: Course may be repeated.

ME 452 (BIOE 452, CHE 452, ENGR 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

ME 453 Mathematical Methods in Engineering II 3 Credits
Theory of complex functions; Cauchy-Riemann relations. Integration in the complex plane, Cauchy's integral formula. Laurent series; singular points; contour integrals; Fourier and Laplace transforms. Evaluation of real integrals; Cauchy principal values. Laplace's equation; conformal mappings; Poisson formulae. Singular integral equations. Classification of partial differential equations. Hyperbolic systems of partial differential equations; uniqueness, shock formation. Nonlinear parabolic equations; Burger's equation.

ME 454 Automatic Control of Aerospace Vehicles 3 Credits
The forces and moments acting on aircraft are developed from basic aerodynamics and used to determine the equations of motion and the resulting dynamic models. Analysis from these dynamic models supports the design of flight control, guidance, and autopilot systems. Modern control methods for missiles and spacecraft are also included. Effects of flexible structures are developed. Cannot receive credit if previously completed ME 354.
Prerequisites: MECH 326 and MECH 343

ME 456 Astrodynamics 3 Credits
Kepler's Laws are proven from basic mechanics, then used to determine the equations of motion for a satellite. Subsequent topics include various kinds of orbits in use today, orbit determination, orbital maneuvers, and rendezvous. Interplanetary trajectories, satellite attitude dynamics, rocket vehicles, and orbital perturbations are also discussed. ME 456 is the graduate level version of ME 356; requires additional assignments and/or projects appropriate for graduate level study. Credit will not be given for both ME 356 and ME 456.

ME 460 Engineering Project 1-6 Credits
Project work on some aspect of mechanical engineering in an area of student and faculty interest. Selection and direction of the project could involve interaction with local communities or industries. Consent of department required.
Repeat Status: Course may be repeated.

ME 461 Integrated Product Development (IPD) Projects-1 2 Credits
Technical and economic feasibility study of new products. Selection and content of the project is determined by the faculty project advisor in consultation with the student, progress and final reports, oral and posters presentations. Consent of the program director and faculty project adviser required.
Prerequisites: TE 401 or ME 401

ME 462 IPD: Manufacturing 3 Credits
Industry sponsored Integrated Product Development Project (IPD) projects. The student works with an industry sponsor to create detailed design specifications, fabricate and test a prototype new product and plan for production. Selection and content of the project is determined by the faculty project advisor in consultation with the industry sponsor. Deliverables include progress and final reports, oral presentations, posters and a prototype. Consent of the department chair and faculty project advisor required.

ME 464 Renewable Energy 3 Credits
Fundamentals and design aspects of Renewable Energy (RE) technologies; bio-fuels, hydropower, solar photovoltaic, solar thermal, wind, geothermal energies. Details and difficulties in implementing RE. ME 464 is graduate level version of ME 364 and will require additional assignments and/or projects appropriate for graduate level study. Closed to students who have taken ME 364.

ME 468 Advanced Energy Efficiency Practicum 3 Credits
Critical assessments of energy management systems. Establishment of framework for industrial facilities to manage energy systems. Fundamentals of best practices for energy efficiencies associated with industrial energy savings. Progress and final reports required. Engineering graduate students only. Consent of instructor required.

ME 475 Directed Studies 1-3 Credits
Special problems related to a topic in mechanical engineering and mechanics.

ME 485 Polymer Product Manufacturing 3 Credits
An exploration of the science underlying polymer processes such as injection molding through a combination of theory development, practical analysis, and utilization of commercial software. Polymer chemistry and structure, material rheological behavior, processing kinetics, molecular orientation development, process simulation software development, manufacturing defects, manufacturing window establishment, manufacturing process design, manufacturing process optimization. This course is a version of ME 385 for graduate students, with research projects and advanced assignments. Closed to students who have taken ME 385. Must have graduate level standing in engineering or science.

ME 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

ME 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Mechanics Courses

MECH 002 Elementary Engineering Mechanics 3 Credits
Static equilibrium of particles and rigid bodies. Elementary analysis of simple truss and frame structures, internal forces, stress, and strain. Credit will not be given for both MECH 002 and MECH 003.
Prerequisites: (MATH 022 or MATH 052 or MATH 032) and (PHY 010 or PHY 011)
Can be taken Concurrently: MATH 022, MATH 052, MATH 032

MECH 003 Fundamentals of Engineering Mechanics 0,3 Credits
Static equilibrium of particles and rigid bodies. Analysis of simple truss and frame structures, internal forces, stress, strain, and Hooke's Law, torsion of circular shafts; pure bending of beams. Is intended as a prerequisite for MECH 012. Credit not given for both MECH 002 and MECH 003.
Prerequisites: (MATH 022 or MATH 032) and PHY 011
Can be taken Concurrently: MATH 022, MATH 032

MECH 012 Strength of Materials 0,3 Credits
Stress due to normal, bending, and shear loads in beams; stress transformations via Mohr's circle; principal stress analysis; plastic yield criteria; design of thin-walled pressure vessels; deflection of beams and static indeterminacy; finite element analysis of simple structures; stresses in thick-walled cylinders; stress concentration effects.
Prerequisites: MECH 003 and (MATH 023 or MATH 033)
Can be taken Concurrently: MATH 023, MATH 033

MECH 050 Supplemental Topis in Mechanics 1-2 Credits
Completion of material for MECH courses transferred from other institutions. Student will be scheduled for that part of MECH course that is required for completion of missing material. Subject matter and credit hours to be determined by department chair for each student.

MECH 102 Dynamics 3 Credits
Particle dynamics, work-energy, impulse-momentum, impact, systems of particles; kinematics of rigid bodies, kinetics of rigid bodies in plane motion, energy, momentum, eccentric impact.
Prerequisites: (MECH 002 or MECH 003) and (MATH 023 or MATH 033)
Can be taken Concurrently: MATH 023, MATH 033

MECH 103 Principles of Mechanics 4 Credits
Composition and resolution of forces; equivalent force systems; equilibrium of particles and rigid bodies; friction. Kinematics and kinetics of particles and rigid bodies; relative motion; work and energy; impulse and momentum.
Prerequisites: (MATH 023 or MATH 033) and (PHY 010 or PHY 011)

MECH 300 Apprentice Teaching 3 Credits

MECH 302 Advanced Dynamics 3 Credits
Fundamental dynamic theorems and their application to the study of the motion of particles and rigid bodies, with particular emphasis on three-dimensional motion. Use of generalized coordinates; Lagrange's equations and their applications.
Prerequisites: MATH 205 and (MECH 102 or MECH 103)

MECH 305 Advanced Mechanics of Materials 3 Credits
Strength, stiffness, and stability of mechanical components and structures. Fundamental principles of stress analysis: three-dimensional stress and strain transformations, two-dimensional elasticity, contact stresses, stress concentrations, energy and variational methods. Stresses and deformations for rotating shafts, thermal stresses in thick-walled cylinders, curved beams, torsion of prismatic bars, and bending of plates. Projects relate analysis to engineering design.
Prerequisites: MECH 012 and MATH 205

MECH 307 Mechanics of Continua 3 Credits
Fundamental principles of the mechanics of deformable bodies. Study of stress, velocity and acceleration fields. Compatibility equations, conservation laws. Applications to two-dimensional problems in finite elasticity, plasticity, and viscous flows.
Prerequisites: MECH 305

MECH 312 Finite Element Analysis 3 Credits
Basic concepts of analyzing general media (solids, fluids, heat transfer, etc.) with complicated boundaries. Emphasis on mechanical elements and structures. Element stiffness matrices by minimum potential energy. Isoparametric elements. Commercial software packages (ABAQUS, NISA) are used. In addition, students develop and use their own finite element codes. Applications to design.
Prerequisites: MECH 012

MECH 313 Fracture Mechanics 3 Credits
Fracture mechanics as a foundation for design against or facilitation of fracture. Fracture behavior of solids; fracture criteria; stress analysis of cracks; subcritical crack growth, including chemical and thermal effects; fracture design and control, and life prediction methodologies.
Prerequisites: MECH 012 and MATH 205

MECH 326 Aerodynamics 3 Credits
Application of fluid dynamics to flows past lifting surfaces. Normal force calculations in inviscid flows. Use of conformal mappings in two dimensional airfoil theory. Kutta condition at a trailing edge; physical basis. Viscous boundary layers. Thin airfoil theory. Section design; pressure profiles and separation. Lifting line theory. Compressible subsonic flows; Prandtl-Glauert Rule. Airfoil performance at supersonic speeds.
Prerequisites: ME 231

MECH 328 Fundamentals of Aircraft Design 3 Credits
Review of dynamic pressure, lift, drag. International Standard Atmosphere. Basics of wing sections. Parasitic and induced drag, best glide ratio and minimum sink of gliders. Basics of planforms, propulsion (piston/propeller and jet). Performance estimates (max speed, climb, endurance, range, stall), stability and trim, aerodynamic moments. Phugoid. Wing spar analysis. Electric aircraft.
Prerequisites: MECH 012

MECH 350 Special Topics 3 Credits
A study of some field of engineering mechanics not covered elsewhere. Consent of department required.

MECH 404 Mechanics & Behavior of Structural Members 3 Credits
Behavior of structural members under a variety of loading conditions in the elastic and inelastic range. Introduction to the theory of elasticity and plasticity. Basics of linear elastic fracture mechanics and fatigue. Analysis of structural member behavior in axial, bending, shear, and torsion. Stability analysis of beam-columns. Beams on elastic foundations. Energy concepts and their use in structural analysis.

MECH 406 Fundamentals of Solid Mechanics 3 Credits
An introductory graduate course in the mechanics of solids. Topics to be addressed include: curvi-linear tensor analysis, analysis of strain and nonlinear kinematics, stress, work conjugate stress-strain measures, conservation laws and energy theorems, variational calculus, isotropic and anisotropic linear elasticity, boundary value problems, beam and plate theories.

MECH 408 Introduction to Elasticity 3 Credits
This course is a first graduate course in solid mechanics. It addresses: kinematics and statics of deformable elastic solids; compatibility, equilibrium and constitutive equations; problems in plane elasticity and torsion; energy principles, approximate methods and applications.

MECH 413 Fracture Mechanics 3 Credits
Elementary and advanced fracture mechanics concepts; analytical modeling; fracture toughness concept; fracture toughness testing; calculation of stress intensity factors; elastic-plastic analysis; prediction of crack trajectory; fatigue crack growth and environmental effects; computational methods in fracture mechanics; nonlinear fracture mechanics; fracture of composite structures; application of fracture mechanics to design.

MECH 418 Finite Element Methods 3 Credits
Finite element approximations to the solution of differential equations of engineering interest. Linear and nonlinear examples from heat transfer, solid mechanics, and fluid mechanics are used to illustrate applications of the method. The course emphasizes the development of computer programs to carry out the required calculations. Must have knowledge of a high-level programming language.

MECH 424 Unsteady Flows 3 Credits
This course examines the forces and flows that arise when rigid or flexible objects produce unsteadiness in a surrounding flow. The concepts of added mass and circulatory forces, hydrodynamic impulse, and vortex force are introduced. For unsteady lifting surfaces, classic theories such as Theodorsen, and von Kármán and Sears are examined. Unsteady flows produced by bluff bodies, such as vortex shedding from a cylinder, are discussed as well as unsteady flows from oscillating bodies, such as flying and swimming animals.

MECH 425 Analytical Methods in Dynamics and Vibrations 3 Credits
This course will mainly cover the following topics: coordinate systems, conservations laws, inertial frames, systems of particles, DAE sets, variable-mass systems, transport equation, review of some of the basic concepts from variational calculus, D'Alembert's principle, Hamilton's principle, Lagrange multipliers, generalized momenta, 3D rigid-body motion, Inertia matrices, Euler angles, inertial and elastic coupling, discrete eigenvalue problem, linearization of nonlinear systems, chaotic systems, Hamilton's principle for continuous systems, Torsion, Sturm-Liouville equations, Rayleigh's quotient, finite-element eigen-problems, interpolating functions, combined-effect vibrations, and some other related topics.

MECH 432 Inelastic Behavior Of Materials 3 Credits
Time-independent and dependent inelastic material behavior. Time-independent plasticity. Yield criteria in multi-dimensions, J2 incremental plasticity in multi-dimensions with associated flow rule. Numerical integration of plasticity equations by radial return and other methods. Deformation theory of plasticity. Time dependent behavior including linear viscoelasticity and nonlinear creep behavior. Nonlinear material behavior at elevated temperatures.

MECH 450 Special Problems 3 Credits
An intensive study of some field of applied mechanics not covered in more general courses.
Repeat Status: Course may be repeated.

Interdisciplinary and Inter-College Undergraduate Study

The university's interdisciplinary programs are designed to cross the boundaries between colleges to accommodate new and developing fields as well as the interests of students. Some of Lehigh's interdisciplinary programs draw on disciplines within a single college; these are housed within that college. Other interdisciplinary programs draw on faculty and curricula in two or more colleges; these are considered inter-college (IC) programs, and these programs are not housed within a specific college. Prospective undergraduate students who wish to apply for one of the IC programs are asked to apply directly to their first choice during the admissions process. Since admission to these programs is highly competitive, applicants are asked to indicate a secondary choice among Lehigh's four undergraduate colleges, should they not be admitted to their first choice IC program.

Computer Science and Business Honors Program

The College of Business and the Computer Science and Engineering Department in the P.C. Rossin College of Engineering and Applied Science jointly offer the Computer Science and Business (CSB) Honors Program. The mission of the program is to provide rigorous computer science education integrated with in-depth business training that prepares high-achieving undergraduate students with diverse backgrounds for lifelong learning and to assume positions of leadership in the business community. This carefully crafted 136 credit-hour degree integrates technology skills in software development with a solid background in business and economics. Deep immersion in both of these areas distinguishes CSB from programs offered by other universities. At the same time, it is well balanced with approximately one third of the courses in liberal arts, one-third in computer science, and one-third in business.

All CSB students participate in the College of Business Student to Professional Co-curriculum (https://businessundergrad.lehigh.edu/lehigh-business-student-professional-co-curriculum/). This program is designed to help students transition from a student to a young professional. They also receive training from the Lehigh Center for Career & Professional Development on technical skills which is integrated in the Computer Science course curriculum. These training combined with academics and experiential learning lead to our students being some of the highest paid upon graduation (see Success after Graduation (https://www1.lehigh.edu/admissions/success-after-graduation/) under College of Business and PC Rossin College of Engineering & Applied Sciences).

After four years, the program leads to a degree in Computer Science and in Business, which is jointly awarded by the College of Business and the P.C. Rossin College of Engineering and Applied Science. Graduates of the program are ideal candidates for placement within public accounting firms, consulting companies, top software firms, and startup companies. This program provides students with the background needed to become the CIOs, decision makers, and general managers of information age corporations.

The CSB Honors Program is a rigorous program. Students may matriculate specifically into the program or apply to enter the program at a later point. Students interested in transferring into the CSB Honors Program after starting at Lehigh must demonstrate a cumulative 3.25 GPA, and must earn a B- or better in ECO 001 AND CSE 007 AND (MATH 021 OR MATH 031 OR MATH 076) and have satisfied all requirements to change their curriculum at Lehigh by the end of the Spring term in which they are applying: https://catalog. (https://catalog.lehigh.edu/undergraduatestudies/curricularflexibility/)lehigh.edu/undergraduatestudies/curricularflexibility/

Applications are due between Jan. 1 and May 15 and can be obtained by contacting the Academic Advisor, Andrea Goff at ahg212@lehigh.edu. All transfer applications will be reviewed and considered at the end of May (once Spring grades are posted) and are dependent on space available in the program. Scheduled or anticipated Summer or Fall coursework cannot be used to satisfy these requirements.

Due to impacts on the graduation timeline, applications to join the CSB Honors Program are not recommended beyond a student's second year of study at Lehigh.

The CSB Honors Program is accredited in Business (AACSB International (https://www.aacsb.edu/accredited/l/lehigh-university/)) and is accredited by the Computing Accreditation Commission of ABET (https://amspub.abet.org/aps/name-search/?searchType=institution&keyword=Lehigh).

The co-directors of the CSB Honors Program are George Witmer, Professor of Practice in the Department of Computer Science and Engineering (gsw2@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinaryundergraduatestudy/computerscienceandbusinessprogram/gsw2@lehigh.edu)) and TBD, College of Business.

For additional information visit the CSB website (https://csb.lehigh.edu/) or contact Andrea Goff, Academic Advisor at ahg212@lehigh.edu.

MISSION FOR PROGRAM

The Computer Science and Business Honors Program's mission is to provide its students with a strong education in mathematics, science, business, and computer science fundamentals and to prepare them to be able to adapt to future changes in the practice of Computer Science.

PROGRAM EDUCATIONAL OBJECTIVES

Graduates of the Bachelor of Science in Computer Science and Business Honors Program will:

- Apply their education in computer science to the analysis and solution of business and industrial problems.
- Account for ethical and social issues when solving business and industrial problems.
- Function effectively in a collaborative team and effectively communicate with members of the team.
- Engage in continued education in their field of expertise.
- Attain positions of expertise in their chosen field.
- Apply their training to problems where information technologies and business processes converge.

STUDENT OUTCOMES

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and business acumen to produce computing-based business solutions.

DEGREE REQUIREMENTS

The required courses for the CSB degree constitute the fundamentals of structured programming, discrete mathematics, algorithms, computer architecture, computer and information systems, programming languages, software engineering, accounting, finance, marketing, management, and economics. None of the program requirements for the CSB major may be taken pass/fail.

The requirements are stated below. To view a number of suggested sequences of courses for satisfying these requirements see Suggested Sequences of Courses (p. 493).

Required Computer Science courses		
CSE 003 & CSE 004	Introduction to Programming, Part A and Introduction to Programming, Part B	4
or CSE 007	Introduction to Programming	
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 140	Foundations of Discrete Structures and Algorithms	3
CSE 202	Computer Organization and Architecture	3
CSE 216	Software Engineering	3
CSE 241	Database Systems and Applications	3
or CSE 341	Database Systems, Algorithms, and Applications	
CSE 262	Programming Languages	3
CSE 303	Operating System Design	3
CSE 340	Design and Analysis of Algorithms	3
CSE Elective from approved list [2]		3
Required Business courses		
BUS 001	Foundations of Business	1
ACCT 151	Introduction to Financial Accounting	3
ACCT 152	Introduction to Managerial Accounting	3
ECO 001	Principles of Economics	4
ECO 146	Intermediate Microeconomic Analysis	3
or ECO 119	Intermediate Macroeconomic Analysis	
FIN 125	Introduction to Finance	3
LAW 201	Legal Environment of Business	3
SCM 186	Supply Chain Operations Management	3
MGT 043	Organizational Behavior	3
MKT 111	Principles of Marketing	3
MGT 301	Strategic Management in a Global Environment	3
Required Math and Science courses		
MATH 021	Calculus I (or MATH 075 followed by MATH 076)	4
MATH 022	Calculus II	4
MATH 205	Linear Methods	3
MATH 231	Probability and Statistics	3
or ECO 045	Statistical Methods	
Natural science courses [1]		**12**
Required CSB courses		
CSB 311	Advanced Accounting Information Systems	3
CSB 312	Design of Integrated Business Applications I	3
CSB 313	Design of Integrated Business Applications II	3
Required CSB electives		
Courses approved by program co-directors		9
Humanities and Social Science requirements		
BUS 003	Business Communication I	1.5
WRT 001	Academic and Analytical Writing	3
BUS 203	Business Communication II	1.5
CSE 252	Computers, the Internet, and Society	3
Humanities (HU) electives		6
Social Sciences (SS) electives		3
Free electives		**7**
Total Credits		**136**

[1]

Such that one course has an attached laboratory and such that two courses are in a laboratory science with the first course a prerequisite to the second course. Note that there are some NS courses that, though in a laboratory science, do not include a laboratory; instead the "attached lab" has a separate course number. See Suggested Sequences of Natural Science Courses (http://www.cse.lehigh.edu/academics/undergraduate-computer-science/bs-in-computer-science-and-business/2-uncategorised/174-natural-science-course-sequence/).

[2]

Computer Science & Business Electives (http://www.cse.lehigh.edu/academics/undergraduate-computer-science/bs-in-computer-science-and-business/2-uncategorised/124-csb-choice/) approved list.

CSB TRACKS

Students may choose to use their CSB professional electives to develop areas of concentrations or tracks from courses offered within the CSE department or CBE. In certain cases, the program co-directors may also approve courses from other departments. See some examples of CSB tracks (https://engineering.lehigh.edu/cse/undergraduate-studies/computer-science-business-bs/csb-tracks/). Note: that it is **not** required that a student complete a track, just that students fulfill the 9-credit professional elective requirement.

SAMPLE SEQUENCES OF COURSES

Below are several sample course sequences that fulfill the CSB degree requirements. These are only examples and nothing here is intended to suggest implicit requirements. It should be clear in particular that electives can easily be rearranged. All sample sequences assume a non-Physics science sequence; the first Physics course in the Physics sequence is 5 credits (4-credit course plus 1-credit lab).

None of these samples assume AP credit. Generally, students with AP move courses in the sequence earlier to leave room for more electives in the junior and/or senior years.

Sample A1 assumes MATH 021 in the fall of first year. Sample A2 assumes that MATH 021 is replaced by the sequence of MATH 075 in the fall and MATH 076 in the spring with MATH 022 deferred until sophomore year.

Students contemplating graduate study in computer science or employment at major computing software firms (e.g. Microsoft, Google, Oracle, IBM) should choose MATH 231 instead of ECO 045 and CSE 341 instead of CSE 241 if possible. These student must take CSE 340 prior to senior year. CSE 326 is strongly recommended as an elective choice for these students.

Students seeking to transfer into CSB from Engineering, Business, College of Health or Arts and Sciences, should consult as soon as possible with the program academic advisor. Note that to graduate in the normal 4 years it is necessary for CSB students to:

- Complete CSE 007 by spring of first year
- Complete CSE 017 by fall of second year
- Complete CSE 241 by spring of second year

CSE 007 and CSE 017 are offered fall and spring. CSE 241 is guaranteed only for fall semester.

Computer Science and Business - SAMPLE A1 (MATH 021)

First Year			
First Semester	**CR**	**Second Semester**	**CR**
BUS 001	1	CSE 017	3
BUS 003	1.5	MATH 022	4
CSE 007	4	MATH 231 or ECO 045	3
ECO 001	4	MGT 043	3
MATH 021	4	Science elective-first course in two-course sequence	4
WRT 001	3	BZX 002	0
	17.5		**17**
Second Year			
First Semester	**CR**	**Second Semester**	**CR**
ACCT 151	3	ACCT 152	3
CSE 109	4	CSE 202	3
MATH 205	3	Science elective or second course in science sequence	4
Science elective or second course in science sequence	4	CSE 262	3
CSE 140	3	CSE 340	3
	17		**16**
Third Year			
First Semester	**CR**	**Second Semester**	**CR**
CSE 216	3	BUS 203	1.5
CSE 241	3	CSB 311	3
FIN 125	3	CSB 312	3
Free Elective	3	ECO 146 or 119	3
MKT 111	3	SCM 186	3
Humanities elective	3	LAW 201	3
	18		**16.5**
Fourth Year			
First Semester	**CR**	**Second Semester**	**CR**
CSB 313	3	MGT 301	3
CSE 303	3	CSE elective (See Computer Science & Business Electives)	3
Human electives	3	CSB professional elective	3
CSE 252	3	CSB professional elective	3
CSB professional elective	3	Free electives	1
Free elective	3	Social Science elective	3
	18		**16**

Total Credits: 136

Computer Science and Business - SAMPLE A2 (MATH 075/076)

First Year			
First Semester	**CR**	**Second Semester**	**CR**
BUS 001	1	CSE 017	3
BUS 003	1.5	MATH 076	2
CSE 007	4	ECO 045	3
ECO 001	4	MGT 043	3
MATH 075	2	MKT 111	3
WRT 001	3	Science elective - first course in two-course sequence	4
		BZX 002	0
	15.5		**18**
Second Year			
First Semester	**CR**	**Second Semester**	**CR**
ACCT 151	3	ACCT 152	3
CSE 109	4	CSE 202	3
MATH 022	4	CSE 140	3
SCM 186	3	Science elective or second course in science sequence	4
Science elective or second course in science sequence	4	CSE 216	3
	18		**16**
Third Year			
First Semester	**CR**	**Second Semester**	**CR**
CSE 340	3	BUS 203	1.5
FIN 125	3	CSB 311	3
CSE 241	3	CSB 312	3
MATH 205	3	CSE 252	3
CSB Professional Elective	3	ECO 146 or 119	3
CSB Professional Elective	3	LAW 201	3
	18		**16.5**
Fourth Year			
First Semester	**CR**	**Second Semester**	**CR**
CSB 313	3	MGT 301	3
CSE 303	3	CSE elective (See Computer Science & Business electives)	3
CSE 262	3	CSB professional elective	3
HU Elective	4	HU elective[2]	4
SS Elective[1]	4	Free elective	4
	17		**17**

Total Credits: 136

1

One credit counts as free elective

2

Two credits count as free elective. Note that most HU and SS courses are 4 credits and the credits beyond the total required by CSB contribute towards satisfying the free elective requirement.

COMPUTER SCIENCE & BUSINESS ELECTIVES

In addition to the CSB electives, students are required to take one Computer Science course from the follow

CSE 160	Introduction to Data Science	3
CSE 242	Blockchain Algorithms and Systems	3
CSE 264	Web Systems Programming	3
CSE 265	System and Network Administration	3
CSE 271	Programming in Linux and Windows Operating Systems	3
CSE 302	Compiler Design	3

CSE 313	Computer Graphics	3
CSE 318	Introduction to the Theory of Computation	3
CSE 319	Image Analysis and Graphics	3
CSE 325	Natural Language Processing	3
CSE 326	Fundamentals of Machine Learning	3
CSE 327	Artificial Intelligence Theory and Practice	3
CSE 331	User Interface Systems and Techniques	3
CSE 335	Topics on Intelligent Decision Support Systems	3
CSE 336	Embedded Systems	3
CSE 337	Reinforcement Learning	3
CSE 342	Fundamentals of Internetworking	3
CSE 343	Network Security	3
CSE 345	WWW Search Engines	3
CSE 347	Data Mining	3
CSE 348	AI Game Programming	3
CSE 349	Big Data Analytics	3
CSE 360	Introduction to Mobile Robotics	3
CSE 371	Principles of Mobile Computing	3
CSE 375	Principles of Practice of Parallel Computing	3
CSE 376	Distributed Systems	3

Or other courses as approved by the program co-directors

SUGGESTED SEQUENCES OF NATURAL SCIENCE COURSES

The following is an incomplete list of course sequences that satisfy the requirement: "*two courses are in a laboratory science with the first course prerequisite to the second course*." The exact set of courses depends on what each science department offers each semester.

Any course used for the science requirement must have an "NS" designation in the catalog (and there are some CHM, BIOS, and EES courses that are not "NS" but rather "ND", meaning "not designated"). The sum of all the NS-designated science credits must be at least 12.

We list here only courses that contribute to a prerequisite sequence. These sequences add up to between 7 and 9 credits. The remaining credits to reach a total of 12 may consist of any NS-designated courses.

Astronomy Sequence		
PHY 005 & ASTR 105	Concepts In Physics and Introduction to Planetary Astronomy	7
PHY 010 & ASTR 105	General Physics I and Introduction to Planetary Astronomy [2]	3-7
PHY 011 & ASTR 105	Introductory Physics I and Introduction to Planetary Astronomy [2]	3-7
Biology Sequence		
CHM 030 & BIOS 041	Introduction to Chemical Principles and Introduction to Cellular and Molecular Biology	7
Chemistry Sequences		
CHM 030 & CHM 031	Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems	8
CHM 030 & CHM 110	Introduction to Chemical Principles and Organic Chemistry I	7
CHM 030 & BIOS 041	Introduction to Chemical Principles and Introduction to Cellular and Molecular Biology	7
CHM 040 & CHM 041	Honors General Chemistry I and Honors General Chemistry II	8
CHM 040 & CHM 110	Honors General Chemistry I and Organic Chemistry I [1]	7
CHM 040 & BIOS 041	Honors General Chemistry I and Introduction to Cellular and Molecular Biology	7
Physics Sequences		
PHY 011 & PHY 021	Introductory Physics I and Introductory Physics II [2]	8
PHY 010 & PHY 013	General Physics I and General Physics II [2]	7
PHY 011 & PHY 013	Introductory Physics I and General Physics II [2]	7
Earth and Environmental Science Sequence		
EES 021 & EES 022 & EES 131	Dynamic Earth and Exploring Earth: A Natural Science Laboratory Course and Introduction to Rocks and Minerals	8
EES 025 & EES 022 & EES 152	The Environment and Living Systems and Exploring Earth: A Natural Science Laboratory Course and Ecology	8
EES 028 & EES 022 & EES 152	Conservation and Biodiversity and Exploring Earth: A Natural Science Laboratory Course and Ecology	8
EES 002 & EES 022 & EES 102	Introduction to Environmental Science and Exploring Earth: A Natural Science Laboratory Course and Environmental Science and Sustainability	8

1

May also take optional 1-credit lab: CHM 111

2

May also take optional 1-credit lab: PHY 012

Courses

CSB 242 Blockchain Concepts and Applications 3 Credits
Blockchain is the technology underlying Bitcoin, along with other digital currencies, and a data-management technology applicable broadly in finance, accounting, marketing, supply-chain, and "smart" contracts. It offers the ability to decentralize financial transactions, automate record keeping, and increase privacy. This course gives students the basis for understanding the technological foundations of blockchain and the business impact of blockchain.
Prerequisites: ECO 001 and (BIS 111 or CSE 003 or CSE 007 or CSE 012) and (CSE 017 or MKT 111 or FIN 125 or SCM 186)

CSB 256 Computing/Business Seminar 3 Credits
Business, technical, and cultural aspects of developing, managing, and marketing computing products from the perspectives of researchers, developers, and management. Influences of patents, open source, corporate- and government-funded research, and standards. Case studies show why the best technology may not always win, unexpected impact of technical disruptions, advantages and pitfalls of technical leadership versus “following aggressively”, etc. Studies include startups, mature companies, corporate R&D labs, and academic labs. Course relates to both specific computer-related technology, and current business events.
Prerequisites: ECO 001 and (CSE 109 or CSE 241 or CSE 341)

CSB 273 Leveraging Technology 3 Credits
Explores the types and manner in which technology can improve business outcomes. Lectures and assigned readings cover topics such as business context for leveraging technology, various common and disruptive technologies, and estimating ROI. Using consulting engagements and/or real-world scenarios, students develop and present proposals based on their acquired knowledge. Emphasis is placed on learning how to discover opportunities, determine technologies to address those opportunities, and correlate the application of technology to business metrics to garner the support of decision-makers.
Repeat Status: Course may be repeated.
Prerequisites: CSE 012 or CSE 017 or BIS 111

CSB 304 (ENTP 304) Technology and Software Ventures 3 Credits
Designed from the perspective of functional leaders, course provides a holistic perspective of developing successful software ventures across various industries in an interdisciplinary and experiential environment. Students develop a software-oriented idea, concurrent with module delivery containing best practices, case studies, and subject-matter experts. Examines business model fundamentals, customer discovery, translating requirements to a minimum viable product, agile development, user acquisition, and traction. ENTP Capstone. Prior programming experience or technical background not required. Open to students in any college and major.
Prerequisites: ENTP 101 or CSE 002 or BIS 111

CSB 311 Advanced Accounting Information Systems 3 Credits
Application of computer technology to accounting information systems. Transaction processing systems that support the revenue, conversion, and expenditure cycles of manufacturing, service, and retail business organizations. Topics include process modeling, data modeling, internal controls, corporate IT governance, IT audit techniques, SAP and application of Generalized Audit Software.
Prerequisites: (ACCT 152 or ACCT 108) and (CSE 241 or CSE 341)
Can be taken Concurrently: CSE 241, CSE 341

CSB 312 Design of Integrated Business Applications I 3 Credits
Integrated Product Development (IPD) Capstone I. Industry-based business information systems design project. Information systems design methodology, user needs analysis, project feasibility analysis of design alternatives, and integrated product development methodology. Formal oral and written presentations to clients.
Prerequisites: CSB 311 and (CSE 241 or CSE 341) and CSE 216
Can be taken Concurrently: CSB 311

CSB 313 Design of Integrated Business Applications II 3 Credits
Integrated Product Development (IPD) Capstone Course II. This course extends the industry-based project initiated in CSB 312 into its implementation phase. Detailed design, in-house system construction and delivery, commercial software options, and systems maintenance and support. The practical component of the course is supplemented by several classroom-based modules dealing with topics that lie at the boundary of computer science and business. Formal, oral, and written presentations to clients.
Prerequisites: CSB 312

CSB 314 International Practicum 3 Credits
A faculty led, foreign-based activity to provide students the opportunity to work on consulting, assurance, or other IT–related projects with business organizations, consulting companies, and public accounting firms. Typical projects: systems analysis and design, systems configuration and implementation, database design, user interface design, and internal control assessment. Students complete written reports and make formal presentations to client firms.

CSB 389 Honors Project 1-12 Credits

CSB 392 Independent Study 1-3 Credits
An intensive study, with report, of a topic spanning both business and computer science that is not treated in any other courses.
Repeat Status: Course may be repeated.

CSB 442 Blockchain: Mathematical Foundations and Financial Applications 3 Credits
Technical and mathematical foundations of blockchain (algorithms, data structures, cryptography) with application to finance. Blockchain properties (immutability, irrefutability), security, consensus (proof-of-work, proof-of-stake, Byzantine consensus). Blockchain governance and trust models. Blockchain and finance: policy, regulation, compliance, systemic risk, relative power of nation-states, the role of central banks, economic justice. Broader impacts in such areas as foreign policy, surveillance and individual freedoms, non-financial applications. Smart contract coding and issues in blockchain software development. Lab experience interacting with a blockchain.
Prerequisites: MATH 021 and FIN 125 and (CSE 007 or CSE 012 or CSE 017)

Global Citizenship

GLOBAL CITIZENSHIP PROGRAM

Website: http://globalcitizenship.cas2.lehigh.edu **(**http://globalcitizenship.cas2.lehigh.edu/**)**

Supported by the Office of International Affairs *(*https://global.lehigh.edu/*) 610-758-2981; invpia@lehigh.edu*
Coxe Hall, 32 Sayre Drive, Bethlehem, PA 18015-3123

The Global Citizenship Program, now Global Citizenship Practitioner-Leaders in Residence (GCP-L), is a one-year residency within the Office of International Affairs/Office of the AVP designed for a small group of sophomores who want to think deeply about how we transform ourselves, how we engage with diverse others, and how we create and sustain change in the world. The residency involves intense engagement with an intimate cohort that loosely represents the global majority in its make-up. Those who are invited to join come ready to do the deep personal work required to take on the world's issues and ready to learn from one another. They are already considering taking part in later OIA engagements such as Iacocca internships, study abroad, application for competitive fellowships, etc., and looking towards a perhaps-undefined but decidedly global path ahead.

Students apply in spring of freshman year and join for the entire sophomore year.

Certificate in Global Citizenship

Core Courses		
GCP 010	Introduction to Global Citizenship (HU)	3
GCP 185	Cosmopolitanism and Culture I (SS) [1]	2
GCP 186	Cosmopolitanism and Culture II (SS) [2]	2
GCP 285	The Citizen and the City	2
GCP 385	Global Citizenship Capstone Course [3]	4
Electives		
Two electives approved by the program director, each at a minimum of 3 credits.		6
International Experience		
Faculty/Director-led study trip with the cohort [4]		
Additional international experience approved by the program director		
Total Credits		**19**

1
Fall Semester

2
Spring Semester

3
Students must take 2 credits of GCP 385 Capstone Course per semester (2 in fall, 2 in spring) for a total of 4 credits.

4

The cohort study trip will take place outside of any formal class days (i.e. Winter break, Spring break, or immediately after the spring semester ends).

Courses

GCP 010 Introduction to Global Citizenship 3 Credits
In this interdisciplinary course, we explore the notion of global citizenship. We examine historical and current frameworks around how diverse sectors and stakeholders are responding to global crises and examine the SDGs. We also take on the inevitable paradoxes, contradictions, hypocrisies and biases that arise in this practice. As individuals, you will work towards forming your own definition/mission statement as a point of departure for taking up an intentional position within the contemporary globalized world.
Attribute/Distribution: SS

GCP 185 Cosmopolitanism and Culture I 2 Credits
Global citizenship assumes awareness of and contact with those unlike ourselves. This course brings us into a sustained consideration of self, other, and difference, in both theory and practice. How do we approach other people and difference in general, and why has this marked such a challenge for us as humans? We will examine Western understandings of self and other as well as non-Western conceptualizations, considering these questions within the frameworks of cosmopolitanism and global citizenship.
Prerequisites: GCP 010
Attribute/Distribution: HU

GCP 186 Cosmopolitanism and Culture II 2 Credits
This course takes us into practice. How can we engage deeply and well with difference as we live our lives and do our work? We will analyze these questions via case studies and through engaging with guest speakers from diverse professional areas. The course includes a study trip as a cohort which will provide a deep dive into global citizenship practice around SDGs in a non-US site. These experiences will deepen our discussions around culture, leadership and collaboration.
Prerequisites: GCP 010 and GCP 185
Attribute/Distribution: HU

GCP 285 The Citizen and the City 2 Credits
Cities are home to a good part of our world. For some, cities are buzzing places of excitement and innovation, interactions and ideas. For others, they are hostile, uncomfortable, sordid and soulless. As a global citizenship practitioner, you are likely to find yourself engaging with urban locales in some way. In this course, we will examine what makes a city healthy, safe, creative, welcoming and otherwise life-sustaining. The course includes experiential elements.
Prerequisites: GCP 010 and GCP 185 and GCP 186

GCP 385 Global Citizenship Capstone Course 2 Credits
This two-semester course (4 credits for the year) invites you into a final set of projects that pull together your learning over your time in the Global Citizenship Program. Each semester will have its own projects and should be taken for 2 credits each.
Repeat Status: Course may be repeated.
Prerequisites: GCP 010 or GCP 185 or GCP 186 or GCP 285
Can be taken Concurrently: GCP 285
Attribute/Distribution: SS

IDEAS: Integrated Degree in Engineering, Arts and Sciences

IDEAS: INTEGRATED DEGREE IN ENGINEERING, ARTS AND SCIENCES

Co-Directors: H. Daniel Ou-Yang, Professor, College of Arts and Sciences; William Best, Professor of Practice, P.C. Rossin College of Engineering and Applied Science

IDEAS is a four-year honors program resulting in an integrated Bachelor of Science (BS) Degree—jointly administered by the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science.

Interdisciplinary education in the arts and sciences and engineering is of significant value to students who will pursue a wide variety of careers. The complex challenges and problems confronting us in the 21st century dramatically underscore the importance of liberally educated and technologically sophisticated individuals whose habits of thought are thoroughly and comfortably interdisciplinary. Moreover, Lehigh is one of a small number of universities with the resources necessary to provide such an education. The students in this program will benefit from the integrated strategic leveraging of strengths across college boundaries.

This program cultivates a new breed of cross-disciplinary innovators. It provides an education that produces students well versed in dual focus areas, one in engineering and one in the arts, humanities, social sciences, mathematics or natural sciences. This educational environment also cultivates a multitude of thinking styles. It is renaissance thinking for the technological era.

Entry Requirements

1. Admitted students who have expressed an interest when applying will be considered for the IDEAS program. Only a limited number of students will be accepted. Students are invited to join this honors program by invitation.
2. To remain in the IDEAS program students must maintain a 3.25 GPA. At the end of the first year, a student with a GPA below 3.25 is given two semesters to achieve a GPA of 3.25; otherwise the student will be asked to transfer to a regular degree program.
3. Students may transfer into the IDEAS program at the end of their first semester or year if space becomes available. A formal application to the program must be filed and approval from the co-directors must be obtained.
4. Students who are interested in the IDEAS program should indicate that interest when applying.

The IDEAS program is designed so that students who transfer out of the program at the completion of the first year will still be able to complete an arts and sciences or engineering degree in four years. The four-year IDEAS program does not lead to an ABET accredited engineering degree. It is possible for students to complete a BS degree in IDEAS and an ABET accredited BS engineering degree (dual degrees) in one or two additional semesters.

PROGRAM COMPONENTS

The IDEAS degree requires a minimum of 136 credits in the program components shown below:

IDEAS Seminars		
IDEA 011	IDEAS Seminar I	2
IDEA 012	IDEAS Seminar II	2
IDEA 111	IDEAS Seminar III	1
IDEA 112	IDEAS Seminar IV	1
IDEA 150	IDEAS Seminar V	1
First-Year Writing [1]		
WRT 001	Academic and Analytical Writing	3
Math/Science core [2]		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
MATH 205	Linear Methods	3
CHM 030	Introduction to Chemical Principles	4
PHY 011 & PHY 012	Introductory Physics I and Introductory Physics Laboratory I	5
Select courses from two of the following disciplines for a total of eight credits:		8
BIOS 041 & BIOS 042	Introduction to Cellular and Molecular Biology and Introduction to Cellular and Molecular Biology Laboratory	
CHM 031	Chemical Equilibria in Aqueous Systems	
CHM 110 & CHM 111	Organic Chemistry I and Organic Chemistry Laboratory I	

EES gateway courses		
MATH 231	Probability and Statistics	
or ISE 111	Engineering Probability	
or BIOS 130	Biostatistics	
PHY 021 & PHY 022	Introductory Physics II and Introductory Physics Laboratory II	
or PHY 013	General Physics II	
Engineering concentration [3]		
Specified by the college, including at least 16 credits of advanced coursework		32
Arts & Science concentration [4]		
Specified by the college, including at least 16 credits of advanced coursework		32
A&S distribution requirements		
Social Science		8
Humanities		8
Free Electives [5]		**14**
Total Credits		**136**

1

First-Year Writing: IDEAS students are required to take one semester of First-Year Writing with WRT 001. Students may fulfill this requirement through appropriate Advanced Placement or International Baccalaureate scores, or approved transfer credit.

2

The math/science core consists of 24 credits of required courses (see table above) plus 8 additional credits drawn from two of the following disciplinary areas: biological sciences, chemistry, EES, physics, math. All students in the IDEAS program will automatically fulfill the CAS math and natural science distribution requirements, as well as most engineering math/science requirements.

3

The engineering concentration consists of a selection of engineering courses drawn from one of the traditional engineering disciplines or from an approved interdisciplinary engineering concentration. The concentration is drawn solely from courses offered within the college of engineering, and requires at least 16 credits of advanced coursework (200-level or above). ENGR 160 or ENGR 200 may not be counted towards the engineering concentration.

4

The arts and sciences concentration consists of a selection of courses drawn either from one of the traditional CAS disciplines or from an approved interdisciplinary concentration. The concentration is drawn solely from courses offered within the college of arts and sciences, and requires at least 16 credits of advanced coursework (200-level or above).

5

Free electives can be taken within any college or outside of the colleges (e.g. CINQ courses) and may contribute to a minor program. ENGR 160 or ENGR 200 may be counted as free electives. CINQ courses may count for up to six credits towards the degree.

Academic Advising

1. The program is jointly administered by co-directors from the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science. They, after the first year, become the secondary academic advisors for all IDEAS students.
2. Primary faculty advisors from appropriate disciplines provide quality curriculum advising in each of the student's chosen concentrations. Careful advising is required because of the greater flexibility of IDEAS.
3. Students who wish to earn an accredited engineering degree in one additional year should inform their advisors.

For general information visit the IDEAS web site at: www.lehigh.edu/IDEAS (http://www.lehigh.edu/ideas/)

Courses

IDEA 011 IDEAS Seminar I 2 Credits
The first year IDEAS core courses will emphasize intensive faculty mentoring within a small seminar environment where students develop, write, and present their individual interest areas and select their concentrations.

IDEA 012 IDEAS Seminar II 2 Credits
The first year IDEAS core courses will emphasize intensive faculty mentoring within a small seminar environment where students develop, write, and present their individual interest areas and select their concentrations.

IDEA 111 IDEAS Seminar III 1 Credit
A continuation of IDEAS 01 & IDEA 012 where interest areas are integrated into themes as individual concentrations are pursued.

IDEA 112 IDEAS Seminar IV 1 Credit
A continuation of IDEAS 011 & IDEA 012 where interest areas are integrated into themes as individual concentrations are pursued.

IDEA 150 IDEAS Seminar V 1 Credit
The Senior-year IDEAS Seminar has students working on team-based projects and focuses on thesis work.

IDEA 250 IDEAS Seminar VII 1 Credit
The senior year honors thesis courses.

IDEA 251 IDEAS Seminar VIII 1 Credit
The senior year honors thesis courses.

IDEA 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

Integrated Business and Engineering Honors Program

INTEGRATED BUSINESS AND ENGINEERING HONORS PROGRAM

After four years and a minimum of 136 credits, students will receive a single Bachelor of Science Degree in Integrated Business and Engineering. The program meets the accreditation standards of AACSB International. Students are required to maintain a minimum GPA of 3.25 in order to remain in the program.

Students in the IBE Honors Program can major in any area of business or engineering that Lehigh offers. After freshman year, each student will elect a major in either the College of Business or the P. C. Rossin College of Engineering and Applied Science.

Students wanting to major in an area of business can select from:

- Accounting
- Business Analytics
- Business Information Systems
- Economics
- Finance
- Marketing
- Management
- Supply Chain Management

Students wanting to major in an area of engineering can select from:

- Biocomputational Engineering
- Bioengineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Computer Science and Engineering
- Electrical Engineering
- Environmental Engineering
- Financial Engineering
- Industrial and Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Structural Engineering

DEGREE REQUIREMENTS (MINIMUM 136 CREDITS)

Writing, Humanities, and Social Science

WRT 001	Academic and Analytical Writing	3
or WRT 003	Composition and Literature I for Multilingual Writers	
BUS 003	Business Communication I	1.5
BUS 203	Business Communication II	1.5
HSS Electives		6
Total Credits		**12**

Math and Science Core

CHM 030	Introduction to Chemical Principles	4
PHY 011	Introductory Physics I	4
PHY 012	Introductory Physics Laboratory I	1
PHY 021	Introductory Physics II	4
PHY 022	Introductory Physics Laboratory II	1
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 023	Calculus III	4
Probability and Statistics		3-6
MATH 231 (3 credits)		
OR ISE 111 and ISE 121 (6 credits total)		
NOTE: IBE-FinE and ISE-ISE should take ISE 111/ISE 121		
ENGR 010	Applied Engineering Computer Methods	2
Total Credits		**31-34**

Business and Economics Core

ECO 001	Principles of Economics	4
ECO 146	Intermediate Microeconomic Analysis	3
or ECO 119	Intermediate Macroeconomic Analysis	
ACCT 151	Introduction to Financial Accounting	3
ACCT 152	Introduction to Managerial Accounting	3
FIN 125	Introduction to Finance	3
BIS 111	Introduction to Information Systems	3
or ISE 224	Information Systems Analysis and Design	
OR CSE 241		
MKT 111	Principles of Marketing	3
LAW 201	Legal Environment of Business	3
MGT 043	Organizational Behavior	3
MGT 243	Leadership in Organizations	3
BUAN 044	Business Analytics I	1.5
BUAN 244	Business Analytics II	1.5
Total Credits		**34**

Required IBE Courses

IBE 010	Integrated Business and Engineering Seminar	1
or ENGR 005	Introduction to Engineering Practice	
or BUS 001		
IBE 050	Integrated Business and Engineering Workshop	3
IBE 150	Integrated Business and Engineering Sophomore Laboratory	1
IBE 250	Integrated Business and Engineering Junior Laboratory	1
IBE 380	Integrated Business and Engineering Capstone Project I	3
IBE 385	Integrated Business and Engineering Capstone Project II	3
IBE Internship Req.		0
Total Credits		**12**

IBE MAJORS

In addition to the core IBE Degree requirements, students must complete their chosen major requirements to meet the minimum credits for the degree.

Engineering and Business majors will follow different guidelines as outlined in the Engineering Majors and Business Majors sections below.

ENGINEERING MAJORS

IBE Core degree requirements	**89-92**
Engineering Major Courses (credits vary by major)	**36-40**
Free Elective credits	**7-14**
Total credit hours required for degree	**136**

BIOCOMPUTATIONAL ENGINEERING

CSE 007	Introduction to Programming	4
CSE 017	Programming and Data Structures	3
MATH 205	Linear Methods	3
BIOS 041	Introduction to Cellular and Molecular Biology	3
BIOS 042	Introduction to Cellular and Molecular Biology Laboratory	1
BIOS 115	Genetics	3
PHY 380	Introduction to Computational Physics	3
or BIOE 363	Numerical Methods for Scientists and Engineers	
BIOE 210	Introduction to Engineering Physiology	4
BIOC 213	Fundamentals of Biomedical Signals	3
BIOC 214	Fundamentals of Biological Modeling	3
BIOC 237	Introductory Molecular Modeling and Simulation	3
Technical Elective		3
Total Credits		**36**

BIOENGINEERING - Biopharmaceutical Track

CHM 031	Chemical Equilibria in Aqueous Systems	4
CHM 110	Organic Chemistry I	3
BIOS 041	Introduction to Cellular and Molecular Biology	3
BIOS 042	Introduction to Cellular and Molecular Biology Laboratory	1
MATH 205	Linear Methods	3
CHE 031	Material and Energy Balances of Chemical Processes	3
BIOE 246	Bioengineering Thermodynamics	4
BIOE 247	Biological Fluid Mechanics	4
BIOE 110	Elements of Bioengineering	4
BIOE 210	Introduction to Engineering Physiology	4
List A Elective		3
Technical Elective		3
Total Credits		**39**

BIOENGINEERING - Bioelectronics & Biophotonics Track

CHM 031	Chemical Equilibria in Aqueous Systems	4
BIOS 041	Introduction to Cellular and Molecular Biology	3
BIOS 042	Introduction to Cellular and Molecular Biology Laboratory	1
MATH 205	Linear Methods	3
ECE 081	Principles of Electrical Engineering	4

ECE 108	Signals and Systems	4
ECE 123	Electronic Circuits	3
MAT 033	Engineering Materials and Processes	3
BIOE 110	Elements of Bioengineering	4
BIOE 210	Introduction to Engineering Physiology	4
List A Elective		3
Technical Elective		3
Total Credits		**39**

BIOENGINEERING - Biomechanics and Biomaterials Track

CHM 031	Chemical Equilibria in Aqueous Systems	4
BIOS 041	Introduction to Cellular and Molecular Biology	3
BIOS 042	Introduction to Cellular and Molecular Biology Laboratory	1
MATH 205	Linear Methods	3
MAT 033	Engineering Materials and Processes	3
MECH 003	Fundamentals of Engineering Mechanics	3
BIOE 110	Elements of Bioengineering	4
BIOE 210	Introduction to Engineering Physiology	4
BIOE 246	Bioengineering Thermodynamics	4
BIOE 247	Biological Fluid Mechanics	4
List A Elective		3
Technical Elective		3
Total Credits		**39**

For All Bioengineering Tracks -- List A Elective Options

CHE 341	Biotechnology I	3
ECE 337	Introduction to Micro- and Nanofabrication	3
ME 315	Bioengineering Statistics	3
BIOE 315	Bioengineering Statistics	3
BIOE 321	Biomolecular & Cellular Mechanics	3
BIOE 341	Biotechnology I	3
BIOE 345	Quantitative Biology	3
BIOE 349	Metabolic Engineering	3
BIOE 363	Numerical Methods for Scientists and Engineers	3

For All Bioengineering Tracks AND Biocomputational Engineering Technical Elective Options

BIOE 308	Genomics	3
BIOE 315	Bioengineering Statistics	3
BIOE 320	Biomedical Image Computing and Modeling	3
BIOE 321	Biomolecular & Cellular Mechanics	3
BIOE 324	Introduction to Organic Biomaterials	3
BIOE 326	Biomimetic and Bio-enabled Materials	3
BIOE 339	Neuronal Modeling and Computation	3
BIOE 341	Biotechnology I	3
BIOE 342	Biotechnology II	3
BIOE 349	Metabolic Engineering	3
BIOE 350	Special Topics	1-4
BIOS 277	Experimental Neuroscience Laboratory	2
BIOS 340	Molecular Basis of Disease	3
BIOS 345	Molecular Genetics	3
BIOS 367	Cell Biology	3
BIOS 371	Elements of Biochemistry I	3
BIOS 372	Elements of Biochemistry II	3
BIOS 381	Physical Biochemistry	3
BIOS 382	Endocrinology	3
CHE 339	Neuronal Modeling and Computation	3
CHE 341	Biotechnology I	3
CHE 342	Biotechnology II	3
CHE 388	Polymer Characterization	3
CHE 391	Colloid and Surface Chemistry	3
CHM 332	Analytical Chemistry	3
CHM 341	Molecular Structure, Bonding and Dynamics	3
CHM 371	Elements of Biochemistry I	3
CHM 372	Elements of Biochemistry II	3
CHM 388	Polymer Characterization	3
CHM 391	Colloid and Surface Chemistry	3
CSE 308	Genomics	3
CSE 320	Biomedical Image Computing and Modeling	3
ECE 202	Introduction to Electromagnetics	3
ECE 333	Medical Electronics	3
ECE 337	Introduction to Micro- and Nanofabrication	3
MAT 324	Introduction to Organic Biomaterials	3
MAT 326	Biomimetic and Bio-enabled Materials	3
MAT 356	Strategies for Nanocharacterization	3
MAT 388	Polymer Characterization	3
ME 315	Bioengineering Statistics	3
PHY 212	Electricity and Magnetism I	3
PHY 352	Modern Optics	3
MAT/BIOE 311	Introduction to Biomaterials	3
ME/BIOE 316	Introduction to Force Spectroscopy	3
CHE/BIOE 318	Soft Materials: Rheology and Characterization	3
CHE/BIOE 345	Quantitative Biology	3
BIOE 257	Biomechanics	3
BIOE/ECE 366	Neural Engineering	3
BIOE/CHE 367	Engineering in Medicine	3
BIOE/CHE 369	Advanced Topics in Regulatory Affairs	3
BIOC 213	Fundamentals of Biomedical Signals	3
PHY 120	Physics of Medical Imaging: Ultrasound and Radiography	3

Other electives may also be accepted with approval from your advisor.

CHEMICAL ENGINEERING

CHM 031	Chemical Equilibria in Aqueous Systems	4
CHM 110	Organic Chemistry I	3
CHM 343	Physical Chemistry Laboratory	2
BIOS 041	Introduction to Cellular and Molecular Biology	3
CHE 031	Material and Energy Balances of Chemical Processes	3
CHE 044	Fluid Mechanics	3
CHE 151	Heat and Mass Transfer	3
CHE 201	Methods of Analysis in Chemical Engineering	4
CHE 202	Chemical and Biomolecular Engineering Laboratory I	3
CHE 211	Chemical Reactor Design	3
CHE 203	Chemical and Biomolecular Engineering Laboratory II	3
CHE 210	Chemical Engineering Thermodynamics	3

CHE 244	Separation Processes	3
Total Credits		**40**

CIVIL ENGINEERING

MATH 205	Linear Methods	3
CEE 003	Engineering Statics	3
CEE 059	Strength of Materials	3
CEE 122	Fluid Mechanics	3
CEE 123	Civil Engineering Materials	3
CEE 142	Soil Mechanics	3
CEE 159	Structural Analysis I	4
CEE 170	Introduction to Environmental Engineering	4
CEE 222	Water Resources Engineering	3
CEE 242	Geotechnical Engineering	3
CEE 262	Fundamentals of Structural Steel Design	3
or CEE 264	Fundamentals of Structural Concrete Design	
Approved Elective		3
List Maintained by Civil and Environmental Engineering Department		
Total Credits		**38**

COMPUTER ENGINEERING

MATH 205	Linear Methods	3
ECE 033	Introduction to Computer Engineering	4
ECE 081	Principles of Electrical Engineering	4
ECE 123	Electronic Circuits	3
ECE 128	FPGA Laboratory	3
ECE 132	Microcontroller Laboratory	3
ECE 201	Computer Architecture	3
CSE 007	Introduction to Programming	4
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 216	Software Engineering	3
Total Credits		**37**

COMPUTER SCIENCE AND ENGINEERING

CSE 007	Introduction to Programming	4
CSE 017	Programming and Data Structures	3
CSE 109	Systems Software	4
CSE 140	Foundations of Discrete Structures and Algorithms	3
CSE 202	Computer Organization and Architecture	3
CSE 216	Software Engineering	3
CSE 252	Computers, the Internet, and Society	3
CSE 262	Programming Languages	3
CSE 303	Operating System Design	3
CSE 340	Design and Analysis of Algorithms	3
Technical Electives		6
List maintained by Computer Science and Engineering Department		
Total Credits		**38**

ELECTRICAL ENGINEERING

MATH 205	Linear Methods	3
ECE 205	C/C++ Programming	3
ECE 132	Microcontroller Laboratory	3
ECE 033	Introduction to Computer Engineering	4
ECE 081	Principles of Electrical Engineering	4
ECE 108	Signals and Systems	4
ECE 121	Electronic Circuits Laboratory	2
ECE 123	Electronic Circuits	3
ECE 126	Fundamentals of Semiconductor Devices	3
ECE 125	Random Signals and Learning	3
ECE 182	Junior Laboratory	1
ECE 257	Senior Lab I	3
ECE 258	Senior Lab II	2
Total Credits		**38**

ENVIRONMENTAL ENGINEERING

MATH 205	Linear Methods	3
CEE 003	Engineering Statics	3
CEE 122	Fluid Mechanics	3
CEE 142	Soil Mechanics	3
CEE 170	Introduction to Environmental Engineering	4
CEE 222	Water Resources Engineering	3
CEE 272	Environmental Risk Assessment	2
CEE 274	Environmental Water Chemistry	3
CEE 275	Environmental, Geotechnics and Hydraulics Laboratory	2
CEE 375	Environmental Engineering Processes	3
CEE 377	Environmental Engineering Design	3
CEE 378	Hazardous Waste Treatment and Management	3
Approved Elective		3
List Maintained by Civil and Environmental Engineering Department		
Total Credits		**38**

FINANCIAL ENGINEERING

MATH 205	Linear Methods	3
ISE 230	Introduction to Stochastic Models in Operations Research	3
ISE 240	Introduction to Deterministic Optimization Models in Operations Research	3
ISE 308	Simulation	3
FIN 323	Investments	3
FIN 328	Corporate Financial Policy	3
FIN Electives		6
Choose 2 from: FIN 324, FIN 330, FIN 333, FIN 334, FIN 335, FIN 336, or FIN 377		
FE Electives		6
Choose 2 from: ECO 357, ISE 309, ISE 339, ISE 372, ISE 347, ISE 358, or ECO 358		
Engineering Electives		6
Choose 2. Courses must have prefix CSE or ECE or CREG or ME or MECH or CEE or MAT or CHE or BIOE or BIOC. Excludes the following courses: CHE 171 (CEE 171, EMC 171, ES 171), CEE 010 (ARCH 010), CSE 012, CSE 042 (EMC 042), CSE 252 (EMC 252, GCP 252), ISE 224, CSE 241, CSE 379, ME 010.		
Students may take only one of the courses in the following groups: Statics (CEE 003 OR MECH 002 OR MECH 003); Strength of Materials (CEE 059 OR MECH 012); Manufacturing (ISE 215 AND ISE 216 OR ME 240)		
Total Credits		**36**

INDUSTRIAL AND SYSTEMS ENGINEERING

ISE 131	Work Systems and Operations Management	3
ISE 230	Introduction to Stochastic Models in Operations Research	3

ISE 240	Introduction to Deterministic Optimization Models in Operations Research	3
ISE 251	Production and Inventory Control	3
ISE 308	Simulation	3
Technical Electives		6
Choose from any 300 level ISE course except ISE 305. One technical elective may be a 200 or 300 level CSE class (excluding CSE 241 and CSE 252).		
Engineering Electives		6
Choose 2. Courses must have prefix CSE or ECE or CREG or ME or MECH or CEE or MAT or CHE or BIOE or BIOC. Excludes the following courses: CHE 171 (CEE 171, EMC 171, ES 171), CEE 010 (ARCH 010), CSE 012, CSE 042 (EMC 042), CSE 252 (EMC 252, GCP 252), ISE 224, CSE 241, CSE 379, ME 010.		
Students may take only one of the courses in the following groups: Statics (CEE 003 OR MECH 002 OR MECH 003); Strength of Materials (CEE 059 OR MECH 012); Manufacturing (ISE 215 AND ISE 216 OR ME 240)		
Choose one of the two options		8-9
CSE 003 and MAT 033 and ISE 215 and ISE 216		
OR		
CSE 007 and ISE 172		
Total Credits		**35-36**

MATERIALS SCIENCE AND ENGINEERING

MATH 205	Linear Methods	3
ECE 083	Introduction to Electrical Engineering	3
MECH 002	Elementary Engineering Mechanics	3
CHE 280	Unit Operations Survey	3
MAT 010	Materials Laboratory	3
MAT 033	Engineering Materials and Processes	3
MAT 201	Physical Properties of Materials	3
MAT 203	Materials Structure at the Nanoscale	3
MAT 205	Thermodynamics of Macro/Nanoscale Materials	3
MAT 216	Diffusion and Phase Transformations	3
MAT 218	Mechanical Behavior of Macro/ Nanoscale Materials	3
Approved Elective		3
List maintained by the Materials Science and Engineering Department		
Total Credits		**36**

MECHANICAL ENGINEERING

MATH 205	Linear Methods	3
ECE 083	Introduction to Electrical Engineering	3
MECH 003	Fundamentals of Engineering Mechanics	3
MECH 012	Strength of Materials	3
MECH 102	Dynamics	3
ME 010	Graphics for Engineering Design	3
ME 021	Mechanical Engineering Laboratory I	1
ME 104	Thermodynamics I	3
ME 121	Mechanical Engineering Laboratory II	1
ME 207	Mechanical Engineering Laboratory III	2
ME 231	Fluid Mechanics	3
ME 240	Manufacturing	3
ME 242	Mechanical Engineering Systems	3
or ME 245 or ME 252		
ME 321	Introduction to Heat Transfer	3
Total Credits		**37**

STRUCTURAL ENGINEERING

MATH 205	Linear Methods	3
CEE 003	Engineering Statics	3
CEE 059	Strength of Materials	3
CEE 117	Numerical Methods in Civil Engineering	2
CEE 123	Civil Engineering Materials	3
CEE 142	Soil Mechanics	3
CEE 159	Structural Analysis I	4
CEE 203	Professional Development	2
CEE 262	Fundamentals of Structural Steel Design	3
CEE 264	Fundamentals of Structural Concrete Design	3
CEE 361	Bridge Systems Design	3
or CEE 363	Building Systems Design	
Approved Electives		6
Approved Elective Options: CEE 207, CEE 259, CEE 266, CEE 365		
Total Credits		**38**

BUSINESS MAJORS

IBE Core degree requirements
89-92

Business Major Courses (credits vary by major)	**15-21**
Credits of engineering courses	**19**
Free Elective credits	**7-14**
Total credit hours required for degree	**136**

Engineering Courses must have one of the following prefixes: BIOC, BIOE, CHE, CEE, CREG, CSE, ECE, ISE, MAT, ME, MECH

Courses excluded from engineering courses:

Courses excluded		
CHE 171	Fundamentals of Environmental Technology	4
CEE 010	Engineering/Architectural Graphics and Design	3
CSE 012	Introduction to Programming with Python	3
CSE 042	Game Design	3
CSE 252	Computers, the Internet, and Society	3
ISE 224	Information Systems Analysis and Design	3
CSE 241	Database Systems and Applications	3
ME 010	Graphics for Engineering Design	3

The Business Core requires one of the following: BIS 111 or ISE 224 or CSE 241. Thus, ISE 224 and CSE 241 may not be taken in the engineering core for business majors.

Due to course similarity, students may take one of the courses in these groups: CSE 003 OR MECH 003 OR MECH 003; CEE 059 OR MECH 012; ISE 215 AND ISE 216 OR ME 240

ACCOUNTING

ACCT 311	Accounting Information Systems	3
ACCT 315	Intermediate Accounting I	3
ACCT 316	Intermediate Accounting II	3
ACCT 324	Advanced Managerial Accounting	3
Concentration, 3 courses - See below		9
Concentrations		
Public Accounting Assurance and Tax Services		
Complete the following courses: ACCT 307, ACCT 320, ACCT 317		
Financial Services and Corporate Accounting		

Complete the following courses: FIN 323, FIN 328, ACCT 318		
Information Technology		
Complete the following courses: ACCT 320, ACCT 330, and one 300-level BIS course (3 credits)		
Total Credits		**21**

BUSINESS ANALYTICS

BIS 342	e-Business Enterprise Applications	3
BUAN 348	Predictive Analytics in Business	3
BUAN 352	Business Analytics and Modelling	3
BUAN 357	Artificial Intelligence for Business	3
Business Analytics Electives		**6**
Choose 2 courses from BIS 335, BUAN 346, SCM 345, ACCT 330, ECO 301, ECO 357, ECO 367, MKT 325/ ECO 325, MKT 326, FIN 377		
Total Credits		**18**

BUSINESS INFORMATION SYSTEMS

Business Core		
BIS 311	Managing Information Systems Analysis and Design	3
BIS 324	Business Data Management	3
BIS 335	Application Development for Business	3
Business Information Systems Electives		**9**
Choose 3 courses from the following: ACCT 311, BIS 333, BIS 342, BIS 344, BUAN 348, BUAN 352, BIS 372, ENTP 304		
Total Credits		**18**

ECONOMICS

Common Economics Core		
ECO 119	Intermediate Macroeconomic Analysis	3
ECO 146	Intermediate Microeconomic Analysis	3
Quantitative Economics Core		
ECO 157	Statistical Methods II	3
Economics Electives		**12**
One course must be taken from each list, and at least two of the four courses must be at the 300 level.		
Electives - Field Courses		
Select from: ECO 209, ECO 229, ECO 303, ECO 304, ECO 311, ECO 312, ECO 322, ECO 338, ECO 339, ECO 352, ECO 353, ECO 358, ECO 363, ECO 365, ECO 368		
Electives - Applying Economics		
Select from: ECO 201, ECO 203, ECO 234, ECO 259, ECO 273, ECO 274, ECO 301, ECO 314, ECO 324, ECO 325, ECO 328, ECO 333, ECO 335, ECO 336, ECO 342, ECO 345, ECO 357, ECO 360, ECO 362, ECO 366, ECO 367, ECO 371, ECO 389		
Total Credits		**21**

FINANCE

Foundation Course Requirement		
FIN 323	Investments	3
FIN 328	Corporate Financial Policy	3
Elective Requirement - Choose 4 courses, at least two with a FIN prefix		**12**
Select from: FIN 324, FIN 330, FIN 333, FIN 334, FIN 335, FIN 336, FIN 337, FIN 377, IE 316, IE 339, MATH 205, MAT 231 (or ISE 121*), MATH 241, MATH 263, MATH 310, Any 300 level , 3 credit ACCT course (except ACCT 371 and ACCT 372), Any 200 level 3 credit ECO course (except ECO 201, ECO 259, ECO 273, ECO 274, ECO 300, ECO 362, ECO 371, and ECO 389), Any 300 level 3 credit Real Estate course (REAL) (Can only count 1 REAL course if also taking FIN 336) * All IBE students except ISE majors must take MATH 231. ISE majors take ISE 111 and ISE 121.		
Total Credits		**18**

MANAGEMENT

Choose one track (15 credits)		**15**
Managing Human Resources Track		
Required Courses: MGT 333, MGT 328 (SCM 328), MGT 363		
Plus two courses chosen from the following list: ECO 235, MGT 374, MGT 342, MGT 379, MGT 381.		
Management Consulting Track		
Required Courses: MGT 306 (ENTP 306), MGT 328 (SCM 328), MGT 314		
Plus two courses chosen from the following list: MGT 346, MGT 374, MGT 333, MGT 342, FIN 328, MKT 319 (ENTP 319), MGT 363, BIS 335, ENTP 304		
Entrepreneurship and Innovation Track		
Required Courses: ENTP 201 (MGT 201), MGT 302 (ENTP 302), ENTP 311 (MGT 311)		
Plus two courses chosen from the following list: ENTP 312 (MGT 312), ENTP 306 (MGT 306), ENTP 319 (MKT 319), MGT 374, MGT 346, MGT 328 (SCM 328)		

MARKETING

Required Courses		
MKT 311	Consumer Behavior	3
MKT 312	Marketing Research	3
MKT 387	Marketing Strategy	3
Elective Courses: Select 3 of the following list:		**9**
MKT 313, MKT 314, MKT 319, MKT 320, MKT 325, MKT 326, MKT 327, MKT 347, MKT 330, MKT 332, MKT 366, MKT 371, MKT 372		
Total Credits		**18**

SUPPLY CHAIN MANAGEMENT

SCM 309	Supply, Cost, and Risk Managment	3
SCM 330	Analytics for Service Operations	3
SCM 340	Demand and Supply Chain Planning	3
SCM 342	e-Business Enterprise Applications	3
SCM 345	Analytical Approaches to Supply Chain Management	3
SCM 354	Integrated Logistics and Transportation Management	3
Total Credits		**18**

Admission to the Integrated Business and Engineering Honors Program is highly selective, with annual admission limited to approximately 50 students. The University's Office of Admissions (610-758-3100) can explain the procedure for applying to the program.

It is possible that a small number of exceptional students may be admitted to the program following the completion of their freshman year. Admission at this point would be highly competitive and based upon freshman year GPA, faculty recommendations, and space availability.

The Academic Advisor for the IBE Honors Program is Jessica Scott (jes819@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinaryundergraduatestudy/integratedbusinessengineering/jes819@lehigh.edu)). The co-directors of the IBE Honors Program are Richard J. Kish,

Professor of Finance (rjk7@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinaryundergraduatestudy/integratedbusinessengineering/rjk7@lehigh.edu)), and Ana Alexandrescu, Professor of Industrial and Manufacturing Systems Engineering (aia210@lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinaryundergraduatestudy/integratedbusinessengineering/aia210@lehigh.edu)). For additional information, visit the IBE web site at ibe.lehigh.edu (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinaryundergraduatestudy/integratedbusinessengineering/ibe.lehigh.edu).

Courses

IBE 010 Integrated Business and Engineering Seminar 1 Credit
Introduction to the various business and engineering professions through a series of presentations and demonstrations. Emphasis is on the diversity of business and engineering career opportunities and the associated curricular choices. Students also create their web page with four-year curriculum plan and an updated resume, learn Cad-Cam and presentation software, and explore career opportunities. Open only to first-year students in the Integrated Business and Engineering Honors Program.

IBE 050 Integrated Business and Engineering Workshop 3 Credits
The course introduces students to the interaction and interdependence of business planning and engineering design in the context of entrepreneurial new product development. Students develop skills in communication, teamwork and critical thinking while working in such areas as competitive strategy, financial modeling, marketing mix, prototyping, product testing, and the development of technical specifications. Open only to students in the Integrated Business & Engineering Honors Program.

IBE 150 Integrated Business and Engineering Sophomore Laboratory 1 Credit
A series of cases that integrate elements of business and engineering. Example topics include, but are not limited to, introduction to cost benefit analysis, introduction to modeling and optimization, team dynamics, and international negotiation and joint ventures. Oral presentations and written reports. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 171 Integrated Business and Engineering Independent Study 1 Credit
Students address a technical issue in a business context from an entrepreneurial focus. Students pursue their own business start-up idea, either a product or a service, and develop a business plan that includes prototypes and testing (engineering) as well as a marketing plan and a base case financial model (business). The goal of the course is for students to enter a business plan or entrepreneurial competition in a local, regional or national level. Open only to students in the Integrated Business and Engineering Honors Program.
Prerequisites: IBE 050

IBE 250 Integrated Business and Engineering Junior Laboratory 1 Credit
A semester-long simulation game in which interdisciplinary teams of IBE students compete against each other. Topics include market analysis, working capital management, capital budgeting, raising long-term capital, plant location, and inventory control. Oral presentations and written reports. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 271 Independent Study 1 Credit

IBE 380 Integrated Business and Engineering Capstone Project I 3 Credits
IBE students work in cross-disciplinary teams of 5 to 6 business and engineering majors with a faculty mentor on the marketing, financial and economic planning, and technical and economic feasibility of actual new product concepts initiated by the course's corporate sponsors. These sponsors are incubator start-up firms to ensure that the projects have both business and engineering elements. Written reports and oral presentations to sponsors and invited venture capitalists are required. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 385 Integrated Business and Engineering Capstone Project II 3 Credits
IBE students continue to work with the detailed design including the fabrication and testing of working prototypes of their new products designed in IBE Capstone Project I course. In addition to the technical design of the products, detailed financial and marketing plans are required. Written reports and oral presentations to sponsors and invited venture capitalists are required. Open only to students in the Integrated Business and Engineering Honors Program.

Military Science

The Department of Military Science, established in 1919, conducts the Army Reserve Officers Training Corps (ROTC) program at Lehigh University. This is one of the oldest ROTC programs in the nation. The Army ROTC program provides a means for students to qualify for a commission as an officer in the Active Army, Army Reserve, or Army National Guard.

OVERVIEW

The objectives of the military science program are to develop leadership and management ability in each student; to provide a basic understanding of the Army's history, philosophy, organization, responsibilities, and role in American society; and to develop fundamental professional knowledge and skills associated with officership. These objectives are achieved through classroom instruction, leadership laboratories, realistic training scenarios, exposure to Army doctrine, professional development, leadership simulations, and individual assessment and counseling. Army ROTC offers a four-year program and a two-year program. The four-year program consists of a two-year basic course and a two-year advanced course. The two-year program consists of the two-year advanced course offered to students with previous military experience, and those who have successfully completed the four-week ROTC Cadet Initial Entry Training. Basic course students incur no obligation for service in the Army as a result of taking these courses.

Basic Course

The basic course, normally taken in the freshman and sophomore years, provides training and instruction in leadership, public speaking, and basic military subjects, such as the Army's role and organizational structure, history and philosophy of the Army, basic tactics, land navigation, first aid, group dynamics, and leadership traits and characteristics. Basic course students incur no military obligation and is only available to freshman and sophomore students.

Advanced Course

The advanced course is normally taken in the junior and senior years. The instruction includes management, military skills, advanced leadership and tactics, logistics, administration, military law, ethics, and professionalism, and includes attendance at the ROTC Cadet Leadership Course (CLC). Students receive subsistence pay during their junior and senior years.

To enroll in the advanced course, an applicant must complete either the basic course or the four-week Cadet Initial Entry Training (CIET); or have received basic course credit for previous military experience.

Note: The Advanced course is a requirement for Scholarship and contracted cadets only and is not offered to participating students.

Uniforms and Equipment

Uniforms are provided to contracted and scholarship cadets only. In the event of lost equipment or uniforms, students will be charged for those items not returned upon leaving the program.

Transfers

Qualified students transferring from another institution may enter the ROTC program at the appropriate level and year, provided they have received the necessary credits, the recommendation of their former professor of military science (if applicable), and the approval of Cadet Command and the university. Please contact the ROTC office for details.

Obligation after Graduation

Upon graduation, a student will receive a commission as a Second Lieutenant in either the Active Army, Army Reserves, or National Guard. If offered active duty, scholarship students serve at least four

years of active duty and four years of inactive ready reserve. If offered reserve duty, students normally serve eight years in a Reserve or National Guard unit.

Graduate Studies

ROTC graduates may request to delay their active service to pursue a full-time course of instruction leading to an advanced degree. The only four major areas of concentration are medical school, law school, veterinary school, and seminary. Delay does not lengthen the active service obligation unless the degree is obtained at government expense.

Course Credit

Students in the College of Arts and Sciences and the College of Business may substitute military science advanced credits for six hours of electives. In the College of Engineering and Applied Science, six credits of advanced ROTC work are permissible within the normal program of each student, irrespective of curriculum. For curricula that include more than six hours of personal electives in the junior and senior years, inclusion of the more than six hours of ROTC credit with normal programs can be effected only with the approval of academic advisers. All military science credits, including those in the basic course, apply toward the student's overall cumulative grade point average.

CAREER OPPORTUNITIES

Individuals are commissioned as officers in the United States Army after completion of the ROTC program including the Cadet Leadership Course (CLC), and the completion of their bachelors degree requirements. They then qualify in one of seventeen branches (specialties) such as the Corps of Engineers, Infantry, Armor, Aviation, Field Artillery, Air Defense Artillery, Signal Corps, Cyber Corps, Military Intelligence, Chemical Corps, Ordnance Corps, Finance, Transportation, Military Police, Adjutant General, Quartermaster, Medical Service Corps, or Nursing. Officers work as leaders/managers, specialists, or combinations of the two depending on the assignment.

PROGRAMS AND OPPORTUNITIES

ROTC Scholarship Program

This program offers an incredible financial benefit for outstanding young men and women in the ROTC program who are interested in a career as an Army Officer. Scholarships provide full annual tuition, a textbook allowance, and common fees; in addition students receive subsistence pay for the period the scholarship is in effect. Lehigh University also contributes a room and board scholarship for each semester the ROTC scholarship is in effect. Any enrolled Cadet with an established college GPA can compete for an Army ROTC scholarship within the Steel Battalion.

Four-year scholarships are open to all eligible high school seniors. Rising seniors may apply for the scholarship at https://www.goarmy.com/rotc/high-school-students/four-year-scholarship.html.

Two-Year Program

Students who want to enroll in ROTC after their sophomore year may apply. Applicants must successfully complete a four-week Cadet Initial Entry Training (CIET) and have two years of undergraduate or graduate studies remaining. The student is paid for the four-week encampment and receives transportation costs to and from the camp. Additional scholarships may be available upon completion of basic camp (CIET).

Physical Facilities

Army ROTC uses areas on and adjacent to the university campus to conduct field training. These locations are excellent for most outdoor activities such as orienteering, patrolling, and survival training. Fort Indiantown Gap Military Reservation, located east of Harrisburg, PA, and Fort Dix, NJ, located east of Philadelphia, PA, are used for various weekend field exercises which allow cadets to apply the classroom leadership and Army doctrine in a training environment.

Off-campus U.S. Army Training Schools

Cadets may be selected to attend the following U.S. Army Schools: Airborne School (Fort Benning, Georgia), Air Assault School (Fort Campbell, Kentucky), Mountain Warfare School (Ethan Allen Training Center, Vermont), and Northern Warfare School (Fort Greely, Alaska) Combat Diver Qualification Course (Key West, Florida), Sapper Leader Course (Fort Leonard Wood, Missouri). This off-campus program is fully funded by the U.S. Army. Many other installations throughout the world may be visited through the Cadet Troop Leader Training program. Nursing students may choose to attend the Nurse Summer Training Program at Army hospitals located throughout the United States.

COMMISSIONING REQUIREMENTS

Individuals must complete either the two- or four-year programs, attend CLC, receive a college degree, have a cumulative GPA of 2.0, and complete all professional military education requirements to become commissioned officers in the United States Army.

COURSE DESCRIPTIONS

Leadership Laboratory is conducted for all students once a week for 60 to 90 minutes. The Leadership Laboratory provides a forum for cadets to exercise their leadership skills amongst their peers.

Instruction at several levels on a variety of subjects with military application provides the context within which students are furnished opportunities to both teach and lead in a group setting. Responsibility is expanded as the student progresses through the program. In the senior year, the students assume the responsibility for the planning, preparation and conduct of the laboratory. Leadership Laboratory is mandatory for all students enrolled in military science courses.

CADET LEADERSHIP COURSE

This is a four-week training program normally conducted at Fort Knox, KY . Prerequisites are:

1. The completion of the basic 100 and 200 level military science courses or the equivalent which is the completion of the Cadet Initial Entry Training (CIET).
2. Scholarship/contracted cadets must have completed all level courses up to and including the 300 level military science courses.

Courses

MIL 010 Introduction to the Army 0,1 Credits
The overall focus is on developing basic knowledge and comprehension of the Army Leadership Requirements Model while gaining a complete understanding of the Reserve Officers' Training Corps (ROTC) program, its purpose in the Army, and its advantages for the student.

MIL 011 Foundations of Agile and Adaptive Leadership 0,1 Credits
Cadets learn how the personal development of life skills such as critical thinking, time management, goal setting, and communication. Cadets learn the basics of the communications process and the importance for leaders to develop the essential skills to effectively communicate in the Army.

MIL 020 Leadership and Decision Making 0,2 Credits
The course adds depth to the Cadets' understanding of the Adaptability Army Learning Area. The outcomes are demonstrated through Critical and Creative Thinking and the ability to apply Troop Leading Procedures (TLP) to apply Innovative Solutions to Problems.
Prerequisites: MIL 010 and MIL 011

MIL 021 Army Doctrine and Team Development 0,2 Credits
The course begins the journey to understand and demonstrate competencies as they relate to Army doctrine. Army Values, Teamwork, and Warrior Ethos and their relationship to the Law of Land Warfare and philosophy of military service are also stressed.
Prerequisites: MIL 010 and MIL 011 and MIL 020

MIL 118 Special Topics for Army Officer 1 Credit

MIL 201 Training Management and the Warfighting Functions 0,3 Credits
It is an academically challenging course where you will study, practice, and apply the fundamentals of Training Management and how the Army operates through the Warfighting functions.
Prerequisites: MIL 010 and MIL 011 and MIL 020 and MIL 021

MIL 202 Applied Leadership in Small Unit Operations 0,3 Credits
It is an academically challenging course where you will study, practice, and apply the fundamentals of direct level leadership and small unit tactics at the platoon level. At the conclusion of this course, you will be capable of planning, coordinating, navigating, motivating and leading a platoon in the execution of a mission.
Prerequisites: MIL 201

MIL 300 Apprentice Teaching 3 Credits

MIL 301 The Army Officer 0,3 Credits
It is an academically challenging course where you will develop knowledge, skills, and abilities to plan, resource, and assess training at the small unit level.
Prerequisites: MIL 202

MIL 302 Company Grade Leadership 0,3 Credits
An academically challenging course where you will develop knowledge, skills, and abilities required of junior officers pertaining to the Army in Unified Land Operations and Company Grade Officer roles and responsibilities.
Prerequisites: MIL 301

Technical Entrepreneurship Program

The Technical Entrepreneurship (TE) program helps students develop the entrepreneurial mindset needed to create, refine and commercialize new products and services, whether in an established company or a start-up. Students enrolled in TE courses learn by experiencing the idea-to-venture process in an education environment that is hard-wired to support the development of novel, innovative, and commercially-viable technologies. The TE programs are based on our 20 years of experience with Lehigh's award-winning Integrated Product Development (IPD) program. In 2012 IPD (Integrated Product Development, now the undergraduate capstone program) was recognized by the National Academy of Engineering for providing real-world entrepreneurial experiences to our students. This program paved the way for interdisciplinary engineering design in the Rossin College.

Graduate TE Program: See Masters of Engineering in Technical Entrepreneurship (https://engineering.lehigh.edu/te/)

Courses

TE 250 (ENTP 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, painstorming, bisociation, the Kano model, trimming technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).
Attribute/Distribution: ND

TE 301 Creativity and Systematic Innovation Methods 3 Credits
Creativity methods, anthropological research, painstorming, bisociation, the Kano model, axiomatic design, the trimming technique, parameter analysis, decomposition, nonlinear design, Taguchi's method, DeBono's Six Hats technique, biomimicry, TRIZ, lateral benchmarking, Blue Ocean Strategy, the art of tinkering and other innovation methods. Hands-on labs, individual and team projects.

TE 303 Methods in Prototyping, Modeling and Testing 3 Credits
Generation of mock-ups and looks-like prototypes, electro-mechanical-optical bread-boards design, fabricate, build and test multiple generations of prototypes, computer modeling methods, shop methods, testing, sensors and data collection. Appropriate use of technology as applied to new product development (no programming required).

TE 310 (ME 310) Directed Study 1-3 Credits
Project work on any aspect of technical entrepreneurship, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the project may be provided by faculty from several departments (possibly interacting with outside consultants, communities and industries). Consent of the Technical Entrepreneurship program director is required.
Repeat Status: Course may be repeated.

TE 400 Technical Entrepreneurship Projects 1 1 Credit
An introduction to technical entrepreneurship projects, customer discovery in selected industry segments, research of target technologies, industries and markets.

TE 401 Integrated Product Development (IPD) Process -1 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. Case studies and semester-long team projects.

TE 402 Integrated Product Development (IPD) Process-2 3 Credits
Continuation of TE 401, the parallel development of the product, the development of the marketing and manufacturing system, manufacturing and marketing launch, sales, service and customer support. Case studies and semester-long team projects.
Prerequisites: TE 401

TE 403 Entrepreneurial Startup Process-1 3 Credits
Key aspects surrounding company startups, including feasibility analysis, business model development and evaluation, formation of new venture teams, financial forecasts, sources of financing. Readings, financial templates, live case studies and guest entrepreneurs.

TE 404 Entrepreneurial Startup Process-2 3 Credits
Continuation of TE 403, integration of key business components to form and launch your venture: industry analysis, marketing plan and sales strategy; mobilization of the new venture team; operations, including space, legal and insurance consideration; and financial management. Selected topics related to respective venture types (i.e. social entrepreneurship, family business, franchising, immigrant entrepreneurs). Lectures, workshops and guest entrepreneurs.
Prerequisites: TE 403

TE 405 Entrepreneurial Startup Projects-1 1 Credit
Applying the concepts and processes developed in parallel with TE 403. Developing your business platform including business model, start-up team, and financial plan to launch and grow your venture.
Prerequisites: TE 400

TE 406 Entrepreneurial Startup Projects-2 3 Credits
Applying the concepts off entrepreneurial startup process, building upon the business model, entrepreneurial team and financing plan developed in TE 405. Developing a comprehensive business plan and investor’s pitch, finalize the steps necessary to launch the company and start operations.
Prerequisites: TE 400 and TE 461

TE 407 Intellectual Property (IP) Creation and Management 2 Credits
Intellectual property issues: confidentiality, nondisclosure, agreement not to compete, founders agreements, patents, copyrights, trademarks, trade secrets both domestic and international.

TE 450 Special topics 1-3 Credits
An intensive study of some aspect of technical entrepreneurship not covered in other general courses. Consent of the program director is required.
Repeat Status: Course may be repeated.

TE 461 Integrated Product Development (IPD) Projects-1 3 Credits
Technical and economic feasibility study of new products. Developing your business platform including business model, startup team, and financial plan to launch and grow your venture. Visualization techniques, visual thinking and envisioning information as taught by Edward Tufte and others, multimedia tools and methods. Selection and content of the project is determined by the faculty project advisor in consultation with the student. Progress report, final report, oral and poster presentations.
Prerequisites: TE 400

TE 462 Integrated Product Development (IPD) Projects-2 3 Credits
Detailed design specification, fabrication, building and testing prototype new products and plan for production, selection and content of the project is determined by the faculty project advisor in consultation with individual students or student teams. Progress and final reports, oral and poster presentations. Consent of program director and faculty project adviser required.
Prerequisites: TE 400 and TE 461

Interdisciplinary Graduate Study and Research

Lehigh's interdisciplinary research centers and institutes address the research needs of government, industry, and society. Organized to recognize research efforts in interdisciplinary problem areas, they supplement the university's academic departments. Graduate students pursuing M.S. and Ph.D. degrees in academic departments, as well as students enrolled in interdisciplinary degree programs, may pursue research opportunities in the various centers.

A complete listing of research centers, institutes, and other research organizations appears following the section on interdisciplinary graduate programs.

INTERDISCIPLINARY GRADUATE DEGREES

In addition to offering graduate degrees within academic departments, Lehigh University offers interdisciplinary graduate degrees in the fields of American studies, business administration and educational leadership, business administration and engineering, catastrophe modeling and resilience, data science, energy systems engineering, environmental policy design, financial engineering, photonics, polymer science and engineering, and technical entrepreneurship.

DUAL DEGREE PROGRAMS

Graduate students are also welcome to pursue a dual master's degree. Students must complete the requirements for both degrees. Course overlap between the two degrees is possible; although a minimum of an additional 15 credits beyond the first master's degree is required. Lehigh offers the following structured dual degree programs:

MEd in Educational Leadership and MBA (Master's of Business Administration)

MBA and MS/MEng in Engineering

MBA and MPH (Master's of Public Health)

CERTIFICATE PROGRAMS

Lehigh University also offers graduate certificate programs in certain specialized fields of study. Graduate certificates consist of a minimum of twelve credits, at least six of which must be at the 400-level. Such certificates are specific to Lehigh and do not constitute official certification, as might be required to be employed professionally. Students are admitted to certificate programs in the same way as to degree programs. More specific information on admission criteria and completion requirements are available from certificate program administrators.

FINANCIAL ASSISTANCE

Teaching assistantships and fellowships are provided by individual academic departments, while research assistantships are available through both academic departments and research centers. Students interested in research are encouraged to seek appointments with members of the faculty working in their areas of special interest, with department chairpersons, or with center or institute directors.

Environmental Policy

We are in a pivotal time for confronting environmental issues and studying the policies and tools necessary to create the communities and world we want to live in. The Master of Arts (MA) in Environmental Policy prepares students to act on the challenges presented by climate change, loss of biodiversity, urbanization, and agriculture. The program's interdisciplinary coursework covers the legal and political structures that do (or might) oversee, regulate, manage, subsidize, or otherwise affect environmental sustainability, environmental injustices, and environmental health. It also teaches about the social practices, moral authority and economic dynamics that affect interventions. Students gain deep insights and pragmatic skills through independent research and community-based projects and internships.

For more information visit Environmental Initiative

Financial Engineering

The objective of the M.S. in Financial Engineering program is to provide students with a strong education in advanced finance, risk management, and quantitative financial analysis tools, grounded in a common series of courses. This sequence will provide key concepts from financial theory, applied mathematics, and engineering. With these building blocks, program graduates will become instrumental in the creation of innovative solutions for real financial problems using state-of-the-art analytical techniques and computing technology.

This program equips students with the necessary skill set to prepare for the Financial Risk Manager® examination offered by The Global Association of Risk Professionals (GARP). (http://www.garp.org/)

Prerequisites

Applicants must show basic competency in the following areas: investments, probability and statistics, and calculus. These courses will not count toward the master's degree. Examples are given from Lehigh courses; prerequisites do not need to be taken at Lehigh.

Investments-REQUIRED		
FIN 323	Investments (OR)	3
GBUS 420	Investments (OR)	3
Equivalent course		
Statistics and Probability-REQUIRED		
MATH 231	Probability and Statistics (OR)	3
ISE 328	Course ISE 328 Not Found (OR)	3
Equivalent introductory calculus-based statistics and probability course		
Calculus Series-REQUIRED		
MATH 021	Calculus I (AND)	0,4
MATH 022	Calculus II (OR)	4
Equivalent calculus series		
Financial Accounting-HIGHLY RECOMMENDED		
ACCT 108	Fundamentals of Accounting (OR)	3
ACCT 151	Introduction to Financial Accounting (OR)	3
GBUS 401	Financial Reporting for Managers and Investors (OR)	3
Equivalent accounting course		
Corporate Finance-HIGHLY RECOMMENDED		
FIN 328	Corporate Financial Policy (OR)	3
GBUS 419	Financial Management (OR)	3
Equivalent course		
Linear Algebra-HIGHLY RECOMMENDED		
MATH 205	Linear Methods (OR)	3
MATH 242	Linear Algebra (OR)	3-4
Equivalent course		
Calculus - HIGHLY RECOMMENDED		

MATH 023	Calculus III (OR)	4
Equivalent Course		

To those admitted without business coursework: Instructors teaching in the MFE Program's Coursework assume that all prospective students have met the prerequisite business foundation requirements. Although we only require an Investments course, we assume that the student has a background in financial accounting, introductory finance, corporate finance, and investments. Please note you will be competing against students within the classroom that have all these business foundation courses. You are encouraged to gain the necessary background by either taking these courses prior to coming to Lehigh or taking these foundation courses during your first term.

To those admitted without the quantitative coursework: Instructors teaching in the MFE Program's Coursework assume that all prospective students have met the prerequisite mathematics foundation requirements. Although we only require a 2-course Calculus series and a math-based Probability/Statistics course, we recommend an Advanced Calculus course, as well as a course in Linear Algebra. Please note you will be competing against students within the classroom that have all these additional foundation courses. You are encouraged to gain the necessary background by either taking these courses prior to coming to Lehigh or taking these foundation courses during your first term.

Required Courses

CORE: 6 courses (18 credits)		
MATH 467	Stochastic Calculus	3
MATH 312	Statistical Computing and Applications (OR)	3,4
STAT 410	Random Processes and Applications	3
GBUS 421	Advanced Investments (Fixed Income)	3
GBUS 422	Derivatives and Risk Management	3
ISE 426	Optimization Models and Applications	3
ISE 447	Financial Optimization	3
ELECTIVES: Choose 3 courses (9 credits) from one of the following 3 tracks		
Quantitative Risk Track		
MATH 468	Financial Stochastic Analysis	3
STAT 439	Time Series and Forecasting	3
GBUS 424	Advanced Topics in Financial Management (Risk Management)	3
Data Science & Financial Analytics Track		
ISE 465	Applied Data Mining	3
ISE 444	Optimization Methods in Machine Learning	3
STAT 438	Statistical Models in Data Science	3
CSB 442	Blockchain: Mathematical Foundations and Financial Applications	3
Financial Operations Track		
GBUS 426	Financial Markets and Institutions	3
GBUS 421	Advanced Investments (Security Analysis)	3
GBUS 424	Advanced Topics in Financial Management (Valuation)	3
Machine Learning Requirement: Choose 1 course (3 credits)		
CSE 326	Fundamentals of Machine Learning (OR)	3
CSE 426	Fundamentals of Machine Learning	3
ISE 364	Introduction to Machine Learning	3
STAT 465	Statistical Machine Learning	3
Capstone: 2 courses (4 credits)		
GBUS 485	Financial Engineering Practicum Capstone I	2
GBUS 487	Financial Engineering Practicum Capstone II	2
Developmental: 2 course sequence (2 credits)		
GBUS 482	Financial Engineering Professional Development I	1
GBUS 483	Financial Engineering Professional Development II	1
TOTAL CREDITS REQUIRED FOR DEGREE		**36**

financial engineering Certificate Programs

The M.S. in Financial Engineering Program offers three certificate programs to candidates in the MFE program. Certificates are available in Data Science & Financial Analytics, Quantitative Risk Management, or Financial Operations Research and may be earned by completing an additional two courses for a total of 36 credit hours. Candidates for the MFE degree do not need to apply initially for certificate programs. Students meet with any Program Director to select their certificate choice (if any) once they are enrolled in the program.

Certificate programs enhance skills and development by allowing additional exploration in three main functional areas.

1. Data Science & Financial Analytics (DSFA) Certificate

The objective is to provide students with a unique skill set preparing them for careers in the interdisciplinary field of Data Science and Financial Analytics, with particular application to the financial services industry. Skills developed include working with massive data sets, data-driven analytical methodologies, SAS and R programming, Data Mining, and Machine Learning.

Curriculum: 12 Credits		
ISE 465	Applied Data Mining (REQUIRED)	3
One of the two courses below:		3
ISE 467	Course ISE 467 Not Found (OR)	
ISE 444	Optimization Methods in Machine Learning	
AND		
MATH 312	Statistical Computing and Applications (REQUIRED)	3
One of two data-intensive finance courses below:		3
GBUS 422	Derivatives and Risk Management (OR)	
GBUS 424	Advanced Topics in Financial Management (Risk Management)	

2. Quantitative Risk Management (QRM) Certificate

The objective is to train students in the quantitative methodologies and regulatory practices that are essential for risk management functions within a financial institution. Prepares students for and reinforces material from the FRM examination. The Financial Risk Manager (FRM) designation is the premier certification for professionals in financial risk management. The two-part exam contains the following topics, many of which overlap the curriculum of the MSFE program: Financial Markets and Products, Valuation and Risk Models, Quantitative Analysis, Foundations of Risk Management, Market Risk, Credit Risk, Operational Risk, Risk Management and Investment Management, and Current Regulatory Issues. Furthermore, Lehigh's MSFE program is an Academic Partner of the Global Association of Risk Professionals (GARP) who administers the FRM certification.

Curriculum: 12 credits		
GBUS 422	Derivatives and Risk Management	3
GBUS 424	Advanced Topics in Financial Management (Risk Management)	3
GBUS 426	Financial Markets and Institutions	3
ONE of the following MATH/STAT courses:		
STAT 434/MATH 334	Mathematical Statistics	3
MATH/STAT 461	Topics In Mathematical Statistcs	3
STAT 438/MATH 338	Statistical Models in Data Science	3

3. Financial Operations Research

The objective is to provide the student with an understanding of the fundamental techniques underlying Operations Research Techniques that are of ubiquitous use in all areas of business today like Linear Programming, Game Theory, Dynamic Programming, Integer Programming, Nonlinear Programming, and Machine Learning.

Curriculum: 12 Credits

ISE 426	Optimization Models and Applications (REQUIRED)	3
ISE 447	Financial Optimization (REQUIRED)	3
Two (2) electives from the following courses:		
ISE 458	Game Theory (OR)	3
ECO 463	Topics in Game Theory	3
ISE 455	Optimization Algorithms and Software	3
ISE 407	Numerical Methods and Scientific Computing	3
ISE 416	Dynamic Programming	3
ISE 444	Optimization Methods in Machine Learning	3
ISE 467	Course ISE 467 Not Found	

PROGRAM ADMISSION REQUIREMENTS

Admission to the MFE program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/admissions-information/) will be based on the applicants essay, resume or CV, transcripts, 2 letters of recommendation, interview, and/or GMAT/GRE test scores if the applicant chooses to submit test scores. International students must show English proficiency. (https://business.lehigh.edu/graduate/english-language-proficiency/)

Lehigh undergraduate students may opt for a 4+1 program (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/accelerated-program/) that would allow the M.S. in Financial Engineering degree to be completed in an accelerated mode.

Further information about the M.S. in Financial Engineering Program may be obtained by visiting the MFE website (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/), contacting the Graduate Programs Office of the College of Business (https://business.lehigh.edu/graduate/contact/) or contacting the program manager/co-directors:

Program Manager

Patrick Zoro, Perella Department of Finance, College of Business

- Lehigh University, 621 Taylor Street, Bethlehem, PA 18015
- Phone (610) 758-2789 / Email pjz218@lehigh.edu

Co-Directors

Dr. Richard Kish, Perella Department of Finance, College of Business

- Lehigh University, 621 Taylor Street, Bethlehem, PA 18015
- Phone (610) 758-4205 / Email rjk7@lehigh.edu

Dr. Daniel Conus, Department of Mathematics, College of Arts & Sciences

- Lehigh University, 17 Memorial Drive E., Bethlehem, PA 18015
- Phone (610) 758-3749 / Email dac311@lehigh.edu

Dr. Luis Zuluaga, Department of Industrial and Systems Engineering, P.C. Rossin College of Engineering & Applied Science

- Lehigh University, 200 W. Packer Avenue, Bethlehem, PA 18015
- Phone (610) 758-5182 / Email luis.zuluaga@lehigh.edu

Graduate Certificates in Arts and Sciences

Graduate certificates in the College of Arts and Sciences are designed to complement a student's graduate program or enhance relevant knowledge in an area of study. The certificate is a flexible program that provides students with breadth of knowledge and the challenge of working outside their home discipline in concentrated interdisciplinary study. More information on these certificates and their requirements can be found below.

CERTIFICATE IN AFRICANA STUDIES

The graduate certificate in Africana Studies is designed as a complement to a graduate program (e.g. English, History, Political Science) or as a standalone post-baccalaureate course of study. In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the Africana Studies Program offers the graduate certificate (p. 65) as a means to enrich academic, personal, and employment horizons.

CERTIFICATE IN COGNITIVE SCIENCE

A graduate certificate (p. 113) in cognitive science provides the opportunity to develop an interdisciplinary perspective on human and machine intelligence. It is available to both enrolled and external students.

CERTIFICATE ENVIRONMENTAL HEALTH

An Environmental Health certificate (p. 142) gives students an in-depth, interdisciplinary overview of the ways the environment - both the built environment and the natural environment - affect individuals' physical and mental health and well-being.

CERTIFICATE IN ENVIRONMENTAL JUSTICE

An Environmental Justice certificate (p. 142) gives students an intensive, interdisciplinary look at the ways the environment - both the built environment and the natural environment - interacts with, reinforces, or might ease economic and racial inequalities.

CERTIFICATE IN ENVIRONMENTAL LAW AND POLICY

This graduate certificate (p. 142) offers a credential in environmental law and policy for individuals with a background in various science, engineering, social science, and humanities fields who wish to understand the theory and practice of environmental and natural resource law at the national, comparative or international level.

CERTIFICATE IN SUSTAINABLE DEVELOPMENT

The certificate program in Sustainable Development (p. 142) considers the feasibility of and best practices for everything from rationalizing urbanization, to ensuring people's economic well-being, to addressing environmental quality and reliance on non-renewable resources, to encouraging social inclusion and equitable growth.

CERTIFICATE IN URBAN ENVIRONMENTAL POLICY AND PLANNING

This graduate certificate (p. 142) looks at the way the built and natural environments, and the policies and programs that shape and affect them, impact particular places, and the way, too, those places impact the people who live, work, and visit them.

CERTIFICATE IN WOMEN, GENDER AND SEXUALITY STUDIES

A certificate in Women, Gender, and Sexuality Studies (p. 278) will be especially beneficial to those who wish to incorporate a broader perspective into their teaching (either in secondary or higher education), and qualifies them for positions that require such expertise. Additionally, individuals interested in fields such as social policy, human resources, and business will also gain from understanding how gender operates at individual, organizational, and institutional levels.

Graduate Certificates in Engineering

Certificate Programs allow students to build relevant and timely skills in an area related to current technological challenges without committing to a full degree, or pursue training that complements your current path of graduate study. For information on available certificates and their requirements please visit our Certificate Programs in Engineering (https://engineering.lehigh.edu/academics/graduate/programs/certificate-programs-engineering/) website.

Graduate Certificates in Intercollegiate Programs

Certificates in Data Science & Financial Analytics, Quantitative Risk Management or Financial Operations Research are available to Lehigh graduate students, provided prerequisites are met. Students may meet with any Program Director listed below to select their certificate choice upon enrollment in a graduate degree program.

Certificate programs enhance skills and development by allowing additional exploration in three main functional areas.

1. DATA SCIENCE & FINANCIAL ANALYTICS (DSFA) CERTIFICATE

Students develop a unique skill set preparing them for careers in the interdisciplinary field of Data Science and Financial Analytics, with particular application to the financial services industry. Skills developed include working with massive data sets, data-driven analytical methodologies, SAS and R programming, Data Mining, and Machine Learning.

Curriculum: (12 credits)

ISE 465	Applied Data Mining (Required)	3
MATH 312	Statistical Computing and Applications (Required)	3,4
One of the two courses below:		
ISE 467	Course ISE 467 Not Found (OR)	3
ISE 444	Optimization Methods in Machine Learning	3
One of the two data-intensive finance courses below:		
GBUS 422	Derivatives and Risk Management (OR)	3
GBUS 424	Advanced Topics in Financial Management (Risk Management)	3

2. QUANTITATIVE RISK MANAGEMENT (QRM) CERTIFICATE

Students are trained in the quantitative methodologies and regulatory practices that are essential for risk management functions within financial institutions.

Curriculum: 12 credits

GBUS 422	Derivatives and Risk Management (Required)	3
GBUS 424	Advanced Topics in Financial Management (Risk Management-Required)	3
GBUS 426	Financial Markets and Institutions (Required)	3
One of the following courses:		
STAT 434/MATH 334	Mathematical Statistics (OR)	3
STAT 438/MATH 338	Linear Models In Statistics with Applications (OR)	3
STAT/MATH 461	Topics In Mathematical Statistics	3

3. FINANCIAL OPERATIONS RESEARCH

Students gain an understanding of the fundamental techniques underlying Operations Research that are of ubiquitous use in all areas of business today, such as Linear Programming, Game Theory, Dynamic Programming, Integer Programming, Nonlinear Programming, and Machine Learning.

Curriculum: 12 credits

ISE 426	Optimization Models and Applications (Required)	3
ISE 447	Financial Optimization (Required)	3
Select 2 courses from the following:		
ISE 407	Numerical Methods and Scientific Computing	3
ISE 416	Dynamic Programming	3
ISE 444	Optimization Methods in Machine Learning	3
ISE 458	Game Theory	3
ISE 455	Optimization Algorithms and Software	3
ISE 467	Course ISE 467 Not Found	3

Contact us:

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- Phone (610) 758-5182 / Email luis.zuluaga@lehigh.edu

Master of Engineering in Technical Entrepreneurship

Lehigh's 11-month, 30-credit, full-time professional Master's program (M.Eng.) in technical entrepreneurship helps young entrepreneurs to develop an entrepreneurial mindset through a process we call "Learn by Doing, Learn by Making and Learn by Launching." Entrepreneurial minded students from ***any undergraduate major*** are encouraged to apply. Students in the program learn by experiencing the idea-to-venture process in an educational environment that's features a dedicated curriculum offered by a dedicated faculty in a dedicated, intellectual property secure maker space. The business community -- from young start-ups to the Fortune 500 -- recognizes the need for curious, creative and innovative young minds with the skills to lead and manage product development teams to create social and economic value. Graduates of the TE MEng program will find themselves well-positioned to take on complex product development roles and assignments in both large and small companies.

Graduate TE Course Sequence

The TE academic calendar begins with the start of the second summer session with 6 credits. Students complete 12 credits each during the fall and spring semesters ending in May of the following year.

Students complete six credits in the second summer session, twelve credits in the fall, twelve credits in the spring.

Summer		
TE 301	Creativity and Systematic Innovation Methods	3
TE 407	Intellectual Property (IP) Creation and Management	2
TE 400	Technical Entrepreneurship Projects 1	1
Fall		
TE 303	Methods in Prototyping, Modeling and Testing	3
TE 401	Integrated Product Development (IPD) Process -1	3
TE 403	Entrepreneurial Startup Process-1	3
TE 461	Integrated Product Development (IPD) Projects-1	3
Spring		
TE 402	Integrated Product Development (IPD) Process-2	3
TE 404	Entrepreneurial Startup Process-2	3
TE 462	Integrated Product Development (IPD) Projects-2	3
TE 406	Entrepreneurial Startup Projects-2	3

Further information can be obtained from: http://www.lehigh.edu/~innovate/

Ms. Susan Kanarek
Graduate Coordinator
P.C. Rossin College of Engineering & Applied Science
(610) 758-4789

Courses

TE 250 (ENTP 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, painstorming, bisociation, the Kano model, trimming technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).
Attribute/Distribution: ND

TE 301 Creativity and Systematic Innovation Methods 3 Credits
Creativity methods, anthropological research, painstorming, bisociation, the Kano model, axiomatic design, the trimming technique, parameter analysis, decomposition, nonlinear design, Taguchi's method, DeBono's Six Hats technique, biomimicry, TRIZ, lateral benchmarking, Blue Ocean Strategy, the art of tinkering and other innovation methods. Hands-on labs, individual and team projects.

TE 303 Methods in Prototyping, Modeling and Testing 3 Credits
Generation of mock-ups and looks-like prototypes, electro-mechanical-optical bread-boards design, fabricate, build and test multiple generations of prototypes, computer modeling methods, shop methods, testing, sensors and data collection. Appropriate use of technology as applied to new product development (no programming required).

TE 310 (ME 310) Directed Study 1-3 Credits
Project work on any aspect of technical entrepreneurship, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the project may be provided by faculty from several departments (possibly interacting with outside consultants, communities and industries). Consent of the Technical Entrepreneurship program director is required.
Repeat Status: Course may be repeated.

TE 400 Technical Entrepreneurship Projects 1 1 Credit
An introduction to technical entrepreneurship projects, customer discovery in selected industry segments, research of target technologies, industries and markets.

TE 401 Integrated Product Development (IPD) Process -1 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. Case studies and semester-long team projects.

TE 402 Integrated Product Development (IPD) Process-2 3 Credits
Continuation of TE 401, the parallel development of the product, the development of the marketing and manufacturing system, manufacturing and marketing launch, sales, service and customer support. Case studies and semester-long team projects.
Prerequisites: TE 401

TE 403 Entrepreneurial Startup Process-1 3 Credits
Key aspects surrounding company startups, including feasibility analysis, business model development and evaluation, formation of new venture teams, financial forecasts, sources of financing. Readings, financial templates, live case studies and guest entrepreneurs.

TE 404 Entrepreneurial Startup Process-2 3 Credits
Continuation of TE 403, integration of key business components to form and launch your venture: industry analysis, marketing plan and sales strategy; mobilization of the new venture team; operations, including space, legal and insurance consideration; and financial management. Selected topics related to respective venture types (i.e. social entrepreneurship, family business, franchising, immigrant entrepreneurs). Lectures, workshops and guest entrepreneurs.
Prerequisites: TE 403

TE 405 Entrepreneurial Startup Projects-1 1 Credit
Applying the concepts and processes developed in parallel with TE 403. Developing your business platform including business model, start-up team, and financial plan to launch and grow your venture.
Prerequisites: TE 400

TE 406 Entrepreneurial Startup Projects-2 3 Credits
Applying the concepts off entrepreneurial startup process, building upon the business model, entrepreneurial team and financing plan developed in TE 405. Developing a comprehensive business plan and investor’s pitch, finalize the steps necessary to launch the company and start operations.
Prerequisites: TE 400 and TE 461

TE 407 Intellectual Property (IP) Creation and Management 2 Credits
Intellectual property issues: confidentiality, nondisclosure, agreement not to compete, founders agreements, patents, copyrights, trademarks, trade secrets both domestic and international.

TE 450 Special topics 1-3 Credits
An intensive study of some aspect of technical entrepreneurship not covered in other general courses. Consent of the program director is required.
Repeat Status: Course may be repeated.

TE 461 Integrated Product Development (IPD) Projects-1 3 Credits
Technical and economic feasibility study of new products. Developing your business platform including business model, startup team, and financial plan to launch and grow your venture. Visualization techniques, visual thinking and envisioning information as taught by Edward Tufte and others, multimedia tools and methods. Selection and content of the project is determined by the faculty project advisor in consultation with the student. Progress report, final report, oral and poster presentations.
Prerequisites: TE 400

TE 462 Integrated Product Development (IPD) Projects-2 3 Credits
Detailed design specification, fabrication, building and testing prototype new products and plan for production, selection and content of the project is determined by the faculty project advisor in consultation with individual students or student teams. Progress and final reports, oral and poster presentations. Consent of program director and faculty project adviser required.
Prerequisites: TE 400 and TE 461

Photonics

PHOTONICS

The Master of Science Degree in Photonics is an interdisciplinary program designed to provide students with a broad training in the various aspects of photonics, including topics in electrical engineering, materials science, and physics. Admission to the program requires a B.S. or M.S. in either the engineering or physical sciences.

Applications should be directed to one of the three sponsoring departments (Electrical and Computer Engineering, Materials Science and Engineering, or Physics). Procedures and admission criteria are the same as those followed by the home department. International students must satisfy minimum university language requirements. The admissions process is under the supervision of the individual department to which you apply.

Polymer Science and Engineering

Lehigh has a diverse group of faculty members with strong, primary interest in polymer science and engineering. In order to provide better opportunities for courses and research in this interdisciplinary field, activities are coordinated through the Polymer Science and Engineering (PSE) graduate program. Polymer faculty from traditional departments of chemical engineering, chemistry, materials science and engineering, physics, and mechanical engineering and mechanics, are participants of the PSE graduate program.

There are two ways in which qualified graduate students, with degrees in the above or related fields, may participate in polymer science and engineering. Students may pursue graduate studies within an appropriate department. Departmental procedures must be followed for the degree sought. The student's adviser must be in that department and the student receives a normal departmental degree, with emphasis in polymer courses and research.

Alternatively, students may elect to pursue studies toward an interdisciplinary Master's degree in polymer science and engineering. Such students are directly admitted into the PSE graduate program and must follow the program's procedures for the degree sought.

Master of Science Degree in Polymer Science and Engineering

Master of Science Degree in Polymer Science and Engineering requires a total of 24 credits in course work and six credits in research. The masters thesis is directed and signed by a faculty member in the Polymer Science and Engineering graduate program and co-signed by the director of the PSE.

For more information, please email us at inpse@lehigh.edu. The program office can be found at Polymer Science and Engineering Graduate Program, Whitaker Laboratory, 5 E. Packer Avenue, Lehigh University, Bethlehem, PA 18015.

An Overview from Past and Present

Lehigh University is independent, nondenominational, and coeducational. Founded in 1865 as a predominantly technical four-year school, the university now has approximately 7,200 undergraduate and graduate students. There are five colleges: the College of Arts and Sciences, the College of Business, the P. C. Rossin College of Engineering and Applied Science, the College of Education (graduate), and the newest, the College of Health, which welcomed its inaugural class during the 2020-21 academic year. Lehigh students come from nearly every state and U.S. territory and more than 40 foreign nations.

The university is primarily situated on the Asa Packer Campus on the north slope of South Mountain overlooking Bethlehem, Pennsylvania. Sayre Park, the wooded refuge located toward the top of the mountain, is the setting for many living groups. The residences are reached via winding private roads. Many residential units on campus command a panoramic view of the Lehigh Valley. The Appalachians are visible to the west, with an especially good view from The Lookout on the Packer Campus. Both the tower and dining room in Iacocca Hall on the Mountaintop Campus afford panoramic views of the Lehigh Valley. The campus at its highest point is 971 feet above sea level.

A substantial portion of the upper level of Lehigh's campus is maintained as a nature preserve. The preserve supports deer, squirrels, chipmunks, raccoons, wild turkeys, and other birds.

Besides the Asa Packer Campus, the university has extensive athletic fields and facilities on the Murray H. Goodman Campus, two miles to the south in Saucon Valley. The university acquired the Mountaintop Campus in 1986; it links the Packer and Goodman campuses. In 2012, the university received a gift from the Donald B. and Dorothy L. Stabler Foundation: 755 acres in nearby Upper Saucon Township. That brought total land holdings to 2,358 acres, making Lehigh one of the largest private universities in the country.

The board of trustees and university officers have established and enforce policies designed to preserve Lehigh's natural beauty. It is their contention that the environment in which the young adult university student pursues knowledge can make the total educational experience more meaningful, and that the ideal environment is separate and unique from the distractions of the nonacademic community.

There are approximately 540 full-time members of the faculty, teaching a total of more than 2,000 course titles (not all of which are offered every semester). Among faculty members who are tenured and to whom the university has a permanent commitment, nearly all hold the doctorate degree (typically Ph.D. or Sc.D.).

In total, there are more than 2,000 employees of the university, making it the second-largest employer in the community.

History and Purpose

The principal author of the brief history of Lehigh University that follows, Dr. W. Ross Yates, held the bachelor of arts and master of arts degrees from the University of Oregon, his native state. He received the doctor of philosophy degree from Yale University and studied in France on a Fulbright Scholarship. He joined the Lehigh staff in 1955 and served as dean of the College of Arts and Sciences from 1963 to 1972. Dr. Yates passed away in 2017.

When the sound of the last cannon of the Civil War died away, statesmen, educators, and industrial pioneers marshalled the victorious forces of the North and turned their attention to education. They wanted to increase the number of trained scientists, engineers, and other skilled individuals so they could transform the vast natural resources of the country into a strong and independent national economy.

Asa Packer was one of those industrial pioneers. He built the Lehigh Valley Railroad and controlled a coal mining empire in the mountains of eastern Pennsylvania. He knew that a strong national economy depended on more than technical skills. It needed, above all, people broadly educated in the liberal arts and sciences — people who could combine practical skills with informed judgments and strong moral self-discipline. He kept this in mind when founding and endowing Lehigh University.

The site that Packer chose for his university was a railroad junction across the Lehigh River from Bethlehem, a community founded in 1741 by Moravian missionaries. William Bacon Stevens, Episcopal bishop of the Diocese of Pennsylvania and the first president of the university's board of trustees, in 1869 described the origin of the university as follows:

"In the fall of 1864 an interview was requested of me by the Hon. Asa Packer, of Mauch Chunk (now Jim Thorpe), Pa. He came to my house in Philadelphia, and said that he had long contemplated doing something for the benefit of his State, and especially of the Lehigh Valley. From that valley he said he had derived much of the wealth which God had given to him, and to the best interests of that valley he wished to devote a portion of it in the founding of some educational institution, for the intellectual and moral improvement of the young men of that region.

"After conversing with him a little while, and drawing out his large and liberal views, I asked him how much money he proposed to set aside for this institution, when he quietly answered that he deigned to give $500,000. At the time of this interview no one in this country, it is believed, had offered in a single sum such an endowment. It was the noblest offering which an American had ever laid on the altar of learning, and more than equaled many royal donations which have carried down the names of kings as patrons of European universities.

"Filled with profound emotions at the mention of such a gift for such an object, I asked the noble donor what specific plans he had dreamed in his own mind in reference to it. His reply was, 'I am not much acquainted with these matters, but you are, and I want you if you will to devise a plan which I can put into effective operation.' I told him that I would make the attempt. I did so. I drew up the outline sketch of such an institution as I thought would give the largest results for the means used, and submitted it in a few weeks to his inspection.

"He examined it with the practical judgment and business habits with which he deals with all great questions, and adopted the scheme as the basis of his future university.

"The first meeting of the Board of Trustees, selected by Judge Packer, met at the Sun Hotel in Bethlehem, July 27, 1865, and began to organize the work before them."

The trustees followed several principles in setting up the university. One was that of combining scientific and classical education. They considered both to be practical. The principle carried forward an ideal of the great 17th century Moravian educator John Amos Comenius. A motto taken from the works of Francis Bacon was used to summarize this principle, namely, Homo minister et interpres naturae — man, the servant and interpreter of nature, to use a free translation. That motto lives on at Lehigh, being an element in the university seal.

The trustees chose as first president a man whose education and habits expressed this principle, Henry Coppee. They established five schools, including a school of general literature in addition to four scientific schools of, respectively, civil engineering, mechanical engineering, mining and metallurgy, and analytical chemistry.

Another principle upon which the trustees insisted was that of keeping the size of the student body proportionate to the abilities of the faculty to teach them well. The university would admit only as many freshmen each year as it could be assured of providing with the highest quality of education. In the 19th century the total enrollment never exceeded several hundred students.

The trustees also insisted that Lehigh was to be nondenominational and would have an admission policy based on merit. Competitive examinations were held for applicants for admission. From 1871 to 1891 no tuition was charged, but the national financial crisis at the turn of the century decimated the value of the Lehigh Valley Railroad stock that Packer had given to Lehigh, which was the principal source of income.

At first the student body was entirely male. The contemporary ideological climate would permit nothing else. But in the fall of 1918, women were admitted to graduate programs for the first time. In 1971, the university opened its undergraduate programs to them as well. Today men and women applicants are considered on an equal basis.

From the first, the students were serious-minded. In 1924, Catherine Drinker Bowen, daughter of President Henry Drinker and later a famous biographer, published a brief history of Lehigh University, in which she commented:

"Ask any college professor which brand of boy he would prefer to teach, the cigarette brand or the flannel shirt variety. Right here we offer ten to one the flannel shirts...Lehigh still holds to the emblem of the flannel shirt—long may it wave! Engineers come to college to work. A writer in the *Syracuse Post* in 1895 spoke truthfully when he said, 'From the first, Lehigh's characteristic has been her earnestness. It is the boast of her graduates, the inspiration of her students. Men go there to learn to take a useful part in the economy of life.'"

The university community was constantly infused with new faculty and students determined to renew and rework the original principles in the light of changing times. The students' ambition and zeal bore fruit; as alumni they carried the university's educational goals into the work of nation-building. And, having received, they gave to perpetuate Lehigh's work of service.

Today, Lehigh University still adheres to Asa Packer's goal of a liberal and scientific education for practical service. Faculty and students work to maintain high quality in instructional programs. Generous support from individuals, foundations, industry, and government help Lehigh to retain a high quality of education and faculty while keeping tuition as low as possible. (Tuition covers only a part of the cost of a Lehigh education.)

Presidents of the University

The presidents of Lehigh University are described and their achievements cited in the following paragraphs. The years in parentheses are those served in the presidency.

Henry Coppee (1866-1875). Coppee served as a railroad engineer in Georgia, a captain in the Army during the Mexican War, and taught at West Point and at the University of Pennsylvania before becoming Lehigh's first president in 1866.

Much building was done on the new university campus. A Moravian church on Packer Avenue was remodeled into Christmas Hall; a house for the president was erected on campus; and Packer Hall, the university center, was built.

Coppee lectured in history, logic, rhetoric, political economy, and Shakespeare.

John McDowell Leavitt (1875-1880). Leavitt was an Episcopal clergyman who graduated from Jefferson College and taught at Kenyon College and Ohio University. During his incumbency, the university was divided into two schools: General Literature and Technology. As of 1876, a student could receive two engineering degrees by taking a longer course, and beginning in 1877 the master of arts, doctor of philosophy, and doctor of science degrees were established.

Linderman Library rotunda was completed in 1877. Asa Packer died in May 1879, and the first Founder's Day was held in his honor the following October.

Robert Alexander Lamberton (1880-1893). Lamberton, a graduate of Dickinson College, practiced law in Harrisburg, Pa., and was a university trustee when asked to become president. During his administration, students and the community witnessed the first Mustard and Cheese dramatic presentation.

A gymnasium (now Coppee Hall) was erected, and Chandler Chemistry Laboratory was built, now known as Chandler-Ullmann Hall. Lehigh was also building its reputation for academic excellence; the mechanical engineering department was established in 1881 and the Lehigh chapter of Phi Beta Kappa was founded in 1887.

Thomas Messinger Drown (1895-1904). Drown studied medicine at the University of Pennsylvania and went abroad to study chemistry. Thereafter he was professor of chemistry at Lafayette College. In 1895 he assumed the presidency of Lehigh and strove to further the university's development as a technical school.

His first years were difficult ones because the Panic of 1893 decimated the university's stock holdings in the Lehigh Valley Railroad. Nevertheless, Lehigh managed to grow in enrollment, academics, and in physical plant. Williams Hall was completed. The curriculum leading to a degree in arts and engineering was established, as was the department of zoology and biology. New curricula were adopted in metallurgical engineering, geology, and physics.

Drown died in office in 1904. Professor William H. Chandler became acting president.

Henry Sturgis Drinker (1905-1920). Drinker, an 1871 Lehigh graduate, was the first university alumnus to become president. In 1907, the alumni endowment fund began, the Lehigh Alumni Bulletin was first published in 1913, and the Alumni Association was incorporated in 1917.

Drinker, besides being a lawyer, was a mechanical engineer and had been largely instrumental in solving the problems of constructing the two-mile-long Musconetcong Tunnel, an engineering feat that made possible a railroad line between Easton, Pa., and New York City. He started a tradition of businesslike management of university affairs.

During Drinker's years, more buildings were completed: the original section of Fritz Engineering Laboratory, Drown Hall, Coxe Mining Laboratory, Taylor Hall, Taylor Gymnasium and Field House, Taylor Stadium, and Lamberton Hall. Drinker's interest in horticulture led to the planting of many rare trees and plants on campus.

A teacher's course and business administration course were begun in 1909 and in 1918 the university was divided into three colleges: liberal arts, business administration, and engineering — the roots of the colleges of today. Army ROTC was established in 1919.

Drinker's daughter, Catherine Drinker Bowen, went on to become a historical writer of note. Her experiences as the daughter of a Lehigh president and occupant of the President's House are recorded in *Family Portrait* (Atlantic Little-Brown).

Drinker resigned in 1920 and Natt M. Emery, vice president, served as chief executive officer until 1922.

Charles Russ Richards (1922-1935). Richards took office in 1922. During his presidency, the first graduate degrees were awarded to women. Lehigh faced a shortage of students from 1929 to 1936 as a result of the Depression, but the newly established Office of Admission, as well as university scholarships, fellowships, and deferred tuition payments, helped to ease the shortage.

Changing concepts of education were evident in several newly organized academic offerings: philosophy, music, psychology, journalism, history, and fine arts. The majors system was instituted, as were the senior comprehensive examinations in the Arts College. The placement bureau, a public relations office, and a student health service were organized.

The Alumni Memorial Building, a memorial to the Lehigh alumni who served in World War I, was opened in 1925 and Packard Laboratory was completed in 1929. In the same decade, a major addition to Linderman Library also was completed.

Clement C. Williams (1935-1944). Williams, a civil engineer, came to Lehigh from the University of Iowa, where he served as dean of the engineering college. He was president of Lehigh during an era of unprecedented alumni support. Undergraduate enrollment rose to an all-time high, passing 2,000 in 1938.

Richards and Drinker residential houses, and the Ullmann wing adjoining the Chandler Chemistry Laboratory, were built. Grace Hall, the first arena-type facility of any size on campus, was completed in 1940, the gift of Eugene G. Grace, an 1899 graduate, who headed the board of trustees. A graduate school implemented the programs in the three colleges. Williams retired in 1944, and the university was without a president for approximately two years.

Martin Dewey Whitaker (1946-1960). Dr. Whitaker, who had been director of the Atomic Energy Commission Laboratory at Oak Ridge,

Tenn., and had worked on the Manhattan Project that developed the atomic bomb, faced the responsibility of helping the university community readjust to peacetime conditions after World War II.

During Whitaker's time as president, Lehigh's assets nearly tripled; the endowment more than doubled to $18 million. Many buildings were renovated, and the Dravo House and McClintic-Marshall House residence halls were built. The faculty increased in number by 75 percent and the first endowed distinguished professorships were established.

The Centennial development program was begun in 1959. It raised more than $22 million for faculty salaries and construction that later included Whitaker Laboratory.

An extensive renovation and enlargement project associated with Packer Hall was undertaken in 1957, and, upon completion in 1958, the building became the university center.

Whitaker died in office.

Harvey A. Neville (1961-1964). Harvey A. Neville was the only faculty member ever elected president. His association with the university began in 1927 as an assistant professor of chemistry. During his relatively short three-year term as president, the first phase of the Saucon Valley athletic complex was completed, and Sayre Field was opened atop South Mountain. The Center for Information and Computing Science was established.

Neville, a strong supporter of research who fostered its growth on campus, died in 1983.

Deming Lewis (1964-1982). Willard Deming Lewis became Lehigh's 10th president after a distinguished career as a space engineer and research administrator.

Dr. Lewis earned three degrees at Harvard and two from England's Oxford University, where he was a Rhodes Scholar in advanced mathematics. In 1941, he joined Bell Telephone Laboratories, and in 1962 he became general manager of systems development with Bellcomm Inc., which engineered systems for the Apollo project that placed the first man on the moon.

Lewis received 33 U.S. patents on such devices as microwave antennas and filter and digital error detection systems. He helped write the equations describing a stylus sliding through a warped groove.

During Lewis' tenure as Lehigh president, women were admitted as undergraduate students in 1971. New majors were begun in natural science, biology, social relations, geological sciences, environmental science and resource management, religion studies, computer engineering, computing and information science, applied mathematics, management science, American studies, and other fields. Six research centers and seven institutes were established.

Capital campaigns brought in more than $130 million, and construction was completed on Maginnes Hall, Whitaker Lab, Mart Science and Engineering Library, Sinclair Lab, the Seeley G. Mudd Building, Neville Hall, Rathbone Hall dining room, 13 fraternity houses, the Centennial I and Centennial II residential complexes, the Brodhead House residence hall, the Trembley Park student apartments, the Saucon Village apartments, the Philip Rauch Field House, and the Stabler Athletic and Convocation Center. The restoration of Packer Memorial Church was completed, and Packard Lab was renovated.

The original Physics Laboratory is now named in Lewis' honor, as is the indoor tennis center.

Peter Likins (1982-1997). Dr. Peter Likins, who earned a B.S. and Ph.D. from Stanford, and an M.S. from the Massachusetts Institute of Technology, became Lehigh's 11th president in 1982. He sought balanced excellence in undergraduate programs while pursuing focused objectives in graduate study and research.

Under Likins, Lehigh nearly doubled in size with the purchase in 1986 of 742 acres of land and a research complex from Bethlehem Steel Corp. The new Mountaintop Campus links the Asa Packer and Goodman campuses.

Lehigh also added many new buildings and facilities. Perhaps most notable was the $33 million Zoellner Arts Center, which provided a new home to Lehigh's departments of music and theatre and to the University Art Galleries, and made Lehigh a center for the fine arts. The arts center and the new Rauch Business Center, home of the College of Business, were built on the site of Taylor Stadium, which was replaced by Goodman Stadium on Lehigh's athletic campus.

Also during Likins' term, Lehigh built a $20 million, state-of-the-art telecommunications system, the E.W. Fairchild-Martindale Library and Computing Center, and the Harold S. Mohler Lab, which honors the former chairman of the board of trustees. Also dedicated was the Sherman Fairchild Center for the Physical Sciences, which includes the renovated Physics Building (renamed Lewis Lab), and the adjoining Sherman Fairchild Lab.

Lehigh became home to the Northeast Tier Ben Franklin Advanced Technology Center, which has helped hundreds of new high-technology businesses get started. And the university led the way in establishing the Colonial League, now the Patriot League, in football. The league is committed to the Lehigh tradition of scholar-athletes.

Likins' term also saw the establishment of the Lehigh Valley Center for Jewish Studies at Lehigh, the Center for Advanced Technology for Large Structural Systems, largest of its kind in North America, and centers in integrated circuits, management studies, chemical process modeling and control, and international studies.

Likins, an expert in spacecraft dynamics and control who has written textbooks in engineering mechanics, was one of 13 science advisers to President George H.W. Bush. He came to Lehigh after serving as dean of engineering and provost at Columbia, and left to become president of the University of Arizona.

William C. Hittinger (1997-1998). A former chair of the university's board of trustees, Hittinger became interim president after the departure of Peter Likins. A member of the National Academy of Engineering, Hittinger served for 22 years on the board of trustees. He graduated from Lehigh in 1944 with a B.S. in metallurgical engineering.

Over a 40-year career in the electronics industry, Hittinger worked for Western Electric Co., National Union Radio Corp., Bell Telephone Laboratories, Bellcomm Inc., General Instrument Corp., and RCA Corp. At Bellcomm, he oversaw systems engineering for NASA's manned spaceflight program, and at RCA, where he became executive vice president, he was responsible for corporate technology, patents, licensing, international business and marketing development, and corporate technology planning.

Hittinger was a member of President Reagan's National Security Telecommunications Advisory Committee from 1982-86. He was also a member of the U.S.-Brazil Presidential Committee on Science and Technology and a member of the board of directors for eight companies.

Hittinger served as national president of the Lehigh Alumni Association in 1971-72 and received the prestigious L-in-Life Award in 1979. An ROTC student at Lehigh, he served in the U.S. Army in 1943-46 during World War II, rising to the rank of captain.

As president, Hittinger realigned the Iacocca Institute into the College of Business, oversaw the construction of the new Sayre Park Village residential complex, and helped Lehigh move forward during a time of presidential transition.

Gregory C. Farrington (1998-2006). Dr. Farrington was appointed Lehigh's 12th president in May 1998 and served the university for eight years before stepping down in June 2006. Proclaiming on many occasions that "the only thing good enough for Lehigh is the best," Farrington promoted academic excellence, improved facilities, and fostered collaborative relationships between Lehigh and the surrounding community.

Farrington earned his B.S. from Clarkson University and his A.M. and Ph.D. from Harvard, all in chemistry and specializing in solid state electrochemistry. Before joining the University of Pennsylvania's Department of Materials Science and Engineering in 1979, he was a research chemist for General Electric Company's Corporate Research and Development Center. At Penn, he served as dean of the School

of Engineering and Applied Science. He holds or shares more than two dozen patents.

While at Lehigh, Farrington established the university's bold and creative Lehigh 2020 Initiative. Launched in October 2000, the $75-million academic venture capital fund focused investment on attracting and retaining the best faculty and students, creating distinctive academic programs, funding critical research fields, and stimulating cross-curricular collaboration. New programs created through the 2020 program include those in bioscience, bioengineering, applied life science, computer science and engineering, information systems and engineering, and bioeconomics.

Along with the reinvigoration of academics and the promotion of interdisciplinary learning, Farrington also literally changed the face of Lehigh's historic campus. More than 20 major campus enhancement projects were completed during his term, among them the construction of Campus Square (since renamed Farrington Square), a new Alumni Memorial Building arrival court and parking garage, and a pedestrian walkway through the heart of the campus green, transforming it into a central gathering place. In addition, Coppee Hall, Lamberton Hall, Maginnes Hall, Wilbur Powerhouse, Grace Hall, the A. Haigh Cundey Varsity House, and Linderman Library were renovated.

Under Farrington's leadership, Shine Forever: The Campaign for Lehigh generated more than half of its $500 million goal to endow faculty chairs, scholarships, academic programs, and facilities.

He also advocated collaborations with the city of Bethlehem, state and federal government, industry, and other partners to strengthen the university and spur regional economic development. His commitment to the Lehigh Valley was evident in his participation on various boards. He actively participated on the board of trustees of St. Luke's Hospital & Health Network, the National Museum of Industrial History, and Lehigh Valley Partnership.

Alice P. Gast (2006-2014) became the 13th president of Lehigh University on August 1, 2006.

Before coming to Lehigh, Dr. Gast served as the vice president for research and associate provost at the Massachusetts Institute of Technology. Prior to joining MIT in 2001, she spent 16 years as a professor of chemical engineering at Stanford University and at the Stanford Synchrotron Radiation Laboratory. She is the co-author of *Physical Chemistry of Surfaces* , a classic textbook on colloid and surface phenomena, and has presented named lectures at several of the nation's leading research institutions.

Gast received her B.S. in chemical engineering from the University of Southern California. After earning her Ph.D. in chemical engineering from Princeton University, she spent a postdoctoral year on a NATO fellowship at the Ecole Superieure de Physique et de Chimie Industrielles in Paris.

Gast has served on numerous advisory committees and boards, including the Board of the American Association for the Advancement of Science and the National Research Council Committee for Science, Technology, and the Law. In 2010, she was named to the post of science envoy by U.S. Secretary of State Hillary Rodham Clinton and the U.S. State Department.

During Gast's tenure as president, Lehigh expanded its footprint with the addition of the 750-acre Stabler Campus, increased its international presence, and expanded innovative approaches to student-directed learning with the launch of the Mountaintop Campus Experience.

Kevin L. Clayton (2014-2015) became interim president after the departure of Alice Gast. He retired from the global investment management firm Oaktree Capital Management, L.P., where he had a distinguished 19-year career. He joined Oaktree in 1995 and founded their Marketing and Client Relations Department; he retired as principal and director of the firm.

Clayton earned his B.A. in government from Lehigh in 1984 and his M.B.A. from St. Joseph's University in 1988. As a Lehigh student, he served as a four-year class president; as a member of the Newman Association and Alpha Tau Omega; and was elected to Omicron Delta Kappa, the national leadership honor society. He continued his service to Lehigh as a member of the Board of Trustees for 22 years, including 5 years as chair.

Clayton and his family have long-standing ties to Lehigh. His late father, William Clayton '51, was a Lehigh trustee for more than 20 years and was a member of the Executive Committee of the Board. In honor of his parents, Clayton and his wife, Lisa, established the William L. and Carol L. Clayton Endowed Scholarship Fund in 2003. In 2008 they established the Lisa A. and Kevin L. Clayton '84 Endowed Scholarship Fund to support students enrolled in Lehigh's South Mountain College. Their contributions also include supporting the Annual Fund, the Athletics Partnership Program, and the Dean's Strategic Initiative. The Claytons' son, Patrick '13, became a member of the third generation of Claytons to earn a Lehigh degree.

During Clayton's term as interim president, he helped many of the university's ongoing projects develop, including Data X, Creative Spaces, and the Mountaintop initiative.

John D. Simon (2015-2021) was installed as Lehigh's 14th president during the annual Founder's Day ceremony on October 2, 2015. Before coming to Lehigh, Dr. Simon was executive vice president and provost at the University of Virginia. Previous to that, he was vice provost of academic affairs at Duke University.

During his tenure at UVA, Dr. Simon spearheaded a number of global initiatives, including the establishment of a new major in global studies and the opening of a physical presence for the university in Asia. He played a leading role in the launch of the university's cutting-edge Data Science Institute as well as its Advanced Research Institute, and in creating the university's Endowment for the Arts.

At Duke, Dr. Simon guided the university's strategic planning process and drove initiatives aimed at connecting the humanities, social sciences, and sciences. He was chairman of Duke's department of chemistry from 1999-2004, and also held appointments in the Duke University Medical Center in both biochemistry and ophthalmology.

Dr. Simon received his B.A. in chemistry from Williams College in 1979 and his Ph.D. from Harvard University in 1983. After a postdoctoral fellowship at UCLA, he joined the department of chemistry and biochemistry at the University of California-San Diego in 1985, then moved to Duke as the George B. Geller Professor of Chemistry in 1998. He has been the recipient of numerous fellowships and awards for his scientific work, including the Presidential Young Investigator Award, Alfred P. Sloan Fellowship, Camille and Henry Dreyfus Teacher Scholar Award, and the Fresenius Award. He is a fellow of the American Association for the Advancement of Science and the American Physical Society.

Under Dr. Simon's leadership, Lehigh established a new College of Health; constructed new residence halls (SouthSide Commons and the Singleton, Hitch, and Maida Houses); elevated the university's commitment to increasing diversity among students, faculty, and staff; launched GO: The Campaign for Lehigh, helping to meet the $1-billion-plus campaign goal; and strengthened the relationship between the university and the City of Bethlehem.

Joseph J. Helble (2021-present) became Lehigh University's 15th president on August 16, 2021 — the second university alumnus to become president. He was installed during the annual Founder's Day ceremony on October 15, 2021. Helble came to Lehigh from Dartmouth College, where he served as provost from 2018-2021. Prior to becoming provost, he served for 13 years as dean of Dartmouth's Thayer School of Engineering.

Before joining Dartmouth, Helble worked as a research scientist at Physical Sciences Inc.; as a faculty member and later chair of chemical engineering at the University of Connecticut; and as the 2004-2005 American Association for the Advancement of Science (AAAS) Roger Revelle Fellow, in which capacity he spent a year addressing technology and environmental policy initiatives in the office of U.S. Senator Joseph Lieberman.

Helble has served on numerous EPA Science Advisory Board panels, and was chair of the American Society for Engineering Education (ASEE) Engineering Deans' Public Policy Committee. He is a recipient of an NSF CAREER Award, an outstanding young faculty award from

the University of Connecticut School of Engineering, and the AAAS Barnard Award. In 2017 he was named a fellow of AAAS.

Helble is the author of over 100 publications on air pollution, aerosols, and nanoscale ceramics, and he holds three U.S. patents. In 2014 he and three Dartmouth colleagues received the National Academy of Engineering Bernard M. Gordon Prize. He holds a BS in chemical engineering from Lehigh and a PhD in chemical engineering from MIT.

University Campuses

Lehigh University's three campuses are located in Bethlehem, Pa., and comprise 1,600 acres.

Asa Packer Campus. Lehigh's main academic campus, encompassing approximately 360 acres on the north slope of South Mountain overlooking Bethlehem, is a wooded area where most students attend class and live. This contains the original campus of the university.

Murray H. Goodman Campus. During the 1960s, the university acquired extensive acreage in the Saucon Valley just south of South Mountain. Development of one of the nation's finest collegiate athletic complexes has continued since that time. The 500-acre campus now includes the Murray H. Goodman Stadium and other athletic fields, as well as the 6,000-seat Stabler Athletic and Convocation Center, the Philip Rauch Field House, the Cundey Varsity House, the Lewis Indoor Tennis Facility, and the Ulrich Sports Complex. The campus is named for a major benefactor, Lehigh alumnus Murray H. Goodman, of West Palm Beach, Fla.

Mountaintop Campus. Lehigh bought this campus from Bethlehem Steel Corp. in 1986. It contains 670 acres of woods and a 72-acre research site with 8 buildings, including a landmark tower building visible for miles around. Acquisition of the facilities connected the two older campuses. The Mountaintop Campus houses the College of Education; the departments of Biological Sciences and Chemical Engineering; programs in biochemistry, biotechnology, bioengineering, ATLSS (Advanced Technology for Large Structural Systems) Center, Energy Research Center, the Military Science and Leadership program (Army ROTC), and Ben Franklin TechVentures headquarters and incubator companies. This campus is also home to the Mountaintop Experience, where students work together beyond the traditional classroom setting on innovative projects that can potentially become business ventures.

University Buildings

Lehigh has a major collection of 19th century buildings designed by such prominent architects as Addison Hutton (1834-1916), Edward T. Potter (1831-1904), A. W. Leh (1848-1918), and the firm of Furness and Evans (Frank Furness, 1839-1912).

Zoellner Arts Center (1996), designed by Dagit Saylor Architects and located just east of the Rauch Business Center (1990), houses a 1,000-seat music auditorium, a 300-seat theatre, a permanent art gallery and museum store, and the departments of music and theatre. A 350-car parking garage is on the same site.

The university has seen numerous buildings constructed and renovated since 2000 on all three campuses. New Mountaintop Campus construction includes an addition to Iacocca Hall for biological sciences (2003), and ongoing renovations in Building C (since 2013) for the Mountaintop Experience.

Recent construction on Goodman Campus includes the Mulvihill Golf Learning Center (2007), the Ulrich Sports Complex (2002), the Gould Shenfeld Half-Time Building (2015), and the Leadership Field Softball Complex and Legacy Field Baseball Complex (2015). Additions have been made to Cundey Varsity House (2002, 2015) and Stabler Arena (2004).

New buildings on the Asa Packer Campus include a police station at Taylor and E. Packer Streets in 2016; the STEPS building (Science, Technology, Environment, Policy and Society) in 2010, Lehigh's first LEED-certified (Leadership in Energy and Environmental Design) building, which achieved Gold status in 2011; Campus Square in 2002, a residential and retail complex (later renamed Farrington Square in honor of Lehigh's 12th president); the Health, Science and Technology Building, which opened in spring 2022 as the home of the College of Health; and the Business Innovation Building, which opened in spring 2023. Williams Hall was completely renovated in 2015 to become a global hub for students, achieving Silver LEED status. There was also an addition to Sinclair Lab in 2005.

Campus enhancements have eliminated vehicular traffic and created landscaped walkways in the historic core of the Asa Packer Campus. A 350-car parking garage pavilion and visitors arrival court (2005) at the west entrance to the Alumni Memorial Building completed the project.

Altogether, the three campuses contain more than 160 buildings with more than 4.5 million square feet of floor space.

Campus Landmarks

In the following list, the date after the name of each building indicates the year of construction.

Alumni Memorial Building (1925). This edifice of Gothic design, housing the Visitor Center, Admissions and other administrative offices, and those of the Alumni Association, represents a memorial to the 1,921 Lehigh alumni who served in World War I and the 46 who died. The building was designed by Theodore G. Visscher, Class of 1899, and James Lindsey Burley, Class of 1894.

E. W. Fairchild-Martindale Library and Computing Center (1985). The high-technology building houses science and engineering holdings, The Media Center, library and technology services staff, and a computer center. Construction was made possible by a major gift from Harry T. Martindale, a 1927 Lehigh graduate, and his wife, Elizabeth, daughter of the late Edmund W. Fairchild, founder of a business publications and communications empire. A recent addition located on the main level, the E.W.F.M. Lounge offers a new dining option.

Linderman Library (1877). The rotunda, designed by Addison Hutton, was built as a gift to the university by founder Asa Packer as a memorial to his daughter, Lucy Packer Linderman. The rotunda is surrounded except on the south by a major addition constructed in 1929. The building houses more than 20,000 rare books and volumes related to the humanities and social science. The Bayer Galleria of Rare Books, made possible by a gift from Curtis F. Bayer '35, was dedicated in 1985. The building reopened in the spring of 2007 as the intellectual and humanities hub of the university after being closed for renovations for nearly two years. Major new features include more seminar and group study rooms, wireless Internet access throughout, central air conditioning, new furniture and finishes, and a cafe.

Packer Memorial Church (1887). The church was the gift of Mary Packer Cummings in memory of her father, founder Asa Packer. It was dedicated on Founder's Day, October 13, 1887. The building was designed by Addison Hutton; the building is on the National Register of Historic Places.

President's House (1868). This 21-room residence, designed by Edward Potter, is the home of university presidents and is often used for receptions on special university occasions.

Packer Hall, The University Center (1868). When construction of the building began in 1865, a railroad was built to transport stone to the site. The building, designed originally by Potter, was extensively renovated and enlarged in 1958.

The building was constructed at the expense of the founder, who vetoed a plan to erect it of brick. "It will be built of stone," Asa Packer responded.

The Clayton University Center closed for renovation in January 2023. Kevin Clayton '84 '13P, former chair of the Board of Trustees and past interim president of Lehigh University, with his wife, Lisa A. Clayton '13P, made the initial gift to fund the update of the Clayton University Center at Packer Hall.

The renovated facility will preserve the historic nature of the building while creating a dynamic, state-of-the-art environment for student life and the entire Lehigh community. Highlights will include spaces where students can collaborate in areas designed for work, learning,

events, casual gatherings, dining, club activities, offices, and student services. The renovation is expected to be completed in 2025.

Academic and Research Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Building C (1968, 2013, 2018). Once Bethlehem Steel's 1960s-era industrial-research facility, Building C is now being transformed (high-bay by high-bay since 2013) into a 21st Century learning environment initiative where Lehigh student's pursue creative and innovative answers to challenges and open-ended questions. In 2018, a beautifully restored three-story crescent welcomed faculty from Computer Science and Engineering and Industrial Systems Engineering departments, Mountaintop Initiative, and the Institute for Data Science and Computational Intelligence. In 2019, the Department of Art, Architecture and Design moved into Highbays C1 and C3, as well as, a portion of the crescent.

Business Innovation Building (2023). Lehigh's newest building, the Business Innovation Building was first planned in 2017 as an expansion for the growing College of business. This 74,000 square foot building was planned to accommodate additional teaching spaces for both the College of Business' undergraduate and graduate programs. It consists of multiple classrooms, study spaces, a mock trading floor, the Center for Business Communication, the Vistex Institute for Executive Education, as well as the Lehigh Business LUminaries exhibit, a celebration of successful College of Business alumni. It also houses an expanded Financial Services Lab and a Behavioral Research Lab.

Chandler-Ullmann Hall (1883, 1938, 2019). These adjoining buildings formerly were the William H. Chandler Chemistry Building (designed by Hutton) and the Harry M. Ullmann Chemistry Laboratory. Chandler served as acting university president, 1904 and 1905, and taught chemistry from 1871 to 1906. Ullmann served as chairman of the chemistry department. The building has been named a National Historic Chemical Landmark by the American Chemical Society.
A major renovation, completed Summer 2019, welcomes the Department of Psychology and the Department of Mathematics.

Christmas-Saucon Hall (1865 and 1872, respectively). Christmas Hall is the university's oldest building. When Asa Packer acquired the South Mountain site for the university in 1865, a Moravian church was being constructed. The newly formed university took over the building and completed it for use in recitations and as a dormitory and chapel. The name Christmas Hall was chosen in keeping with Moravian religious tradition. In 1872, Saucon Hall was constructed a few feet to the east of Christmas Hall. The buildings were connected with the construction of a "hyphen" in 1926. The building is currently being used as a transitional space for Zoellner Arts Administration while awaiting their permanent location.

Coppee Hall (1883). The building was the original university gymnasium. It is named in honor of Henry Coppee, first president. The building was renovated in 2002 and houses the Weinstock Center for Journalism and Communication.

Coxe Hall (1910). Originally a mining laboratory, the structure is named for Eckley B. Coxe, pioneer mining engineer and trustee of the university. The building houses the office of the Vice President for International Affairs, Study Abroad, International Students and Scholars, and the Global Union.

Dialogue Center. This Victorian structure houses the University Chaplain, Muslim Student Life, and Jewish Student Life offices.

Drown Hall (1908). The building, designed by Furness and Evans, is a memorial to Thomas M. Drown, president from 1895 to 1904. It is headquarters for the English Department and the Writing and Math Center.

Fritz Engineering Laboratory (1909, 1955). The laboratory is named for John Fritz, pioneer in the steel industry in the United States and a member of the university's original board of trustees. Fritz provided funds for the original section; a seven-story addition accommodates the university's testing machine, which is capable of applying a five-million-pound load to tension or compression members up to forty feet in length. The hydraulic testing machine is the largest facility of its kind currently in operation in the world. The laboratory is used primarily by the Department of Civil and Environmental Engineering.

Health, Science and Technology Building (HST) (2021). The new College of Health is the largest building Lehigh has ever built. It is a 200,000 square-foot innovative hub that features open-concept labs, integrated workspaces, and shared meeting spaces that allow faculty across disciplines to work side-by-side on interdisciplinary projects.
On the first floor of HST is a community room that welcomes South Bethlehem residents to events, a "green roof" with native plants above the café, and windows that give pedestrians a view of the state-of-the-art research environment. At night, a 60-by-10-foot "Lehigh" sign is illuminated in LED lights at the top of the building.

Iacocca Hall (1958, 2003). Known as the tower building for its panoramic views of the Lehigh Valley, it houses the College of Education, the chemical engineering department, the biological sciences department, The Iacocca Institute plus a teleconferencing classroom. Additionally, this building houses the Iacocca Conference Center, which includes the recently renovated Wood Dining Room, Governor's Suite, and Stabler Observation Tower.

Imbt Laboratories (1958). This is primarily a high-bay research lab space where the ATLSS project was constructed, and where chemical engineering and Energy Research Center have major research facilities. It is also the headquarters of the "Fleet of the Future" program.

Johnson Hall (1955). The building houses the university health service, and counseling service. Earle F. "Coxey" Johnson '07, a director of General Motors Corp. and university trustee, provided funding for the structure.

Jordan Hall (1958). One of the original Bethlehem Steel buildings, this facility now houses the Military Science and Leadership program (Army ROTC) and the Distance Education Department.

Lamberton Hall (1907). The structure served as the university commons and dining room until the renovation of Packer Hall in 1958. The building honors the memory of Robert A. Lamberton, third president. In January of 2006 it reopened as a late-night diner called the "Hawk's Nest" and student programming facility in the Kenner Great Room.

Maginnes Hall (1970). The multilevel structure is headquarters for the College of Arts and Sciences, and also houses the departments of history, international relations, political science and ICAPE (formerly ESL). Classrooms opened on the ground floor in January 2004, and the Center for Career and Professional Development moved onto the fourth floor in 2019. The building is named for Albert B. Maginnes '21, who was a lawyer and university trustee.

Mart Science and Engineering Library (1968). This structure honors the memory of Leon T. Mart '13, and his son, Thomas '51. It was incorporated into the E. W. Fairchild-Martindale Library and Computing Center in 1985.

Seeley G. Mudd Building (1975). This seven-story building houses the chemistry department. The late Seeley G. Mudd was a California medical doctor. The Seeley G. Mudd Foundation, of Los Angeles, made a major gift toward the building.

Neville Hall (1975). This building in the chemistry complex has three auditoriums used for lectures and events. The building is named for Dr. Harvey A. Neville, president from 1961 to 1964, who was a chemist.

Packard Laboratory (1929). The structure was the gift of James Ward Packard, Class of 1884, the electrical pioneer and inventor of the Packard automobile who served as a university trustee. The first Packard automobile (1898) is displayed in the lobby. The building is the headquarters for the P. C. Rossin College of Engineering and Applied Science. It also houses classrooms and laboratories for mechanical engineering and mechanics, for electrical and computer engineering, and computer science and engineering. An auditorium accommodates large classes and various events.

Philosophy Building (1879). This small building just below Packer Memorial Church was constructed as a porter's lodge. Today it houses the philosophy department.

Price Hall (1899) This structure formerly was a brewery named Die Alte Brauerei. In 1912 it was remodeled to serve as a dormitory, and it was named in honor of Henry Reese Price, president of the university board of trustees. Price Hall is the current home of LU Facilities.

Rathbone Hall (1971). This building's upper level is a major and recently renovated student dining facility, with window walls affording a panoramic view of the Lehigh Valley. The building bears the name of its donor, Monroe Jackson Rathbone '21, president of the university board of trustees from 1957 to 1973. Rathbone was chairman of the board, Standard Oil Co. (New Jersey), now Exxon Corp., and was a major innovator in the oil industry. The lower level houses the Residential Services Office and Conference & Special Housing Services.

Rauch Business Center (1990). Philip Rauch '33, L.L.D. '79, retired chairman of the board and director of the Parker-Hannifin Corp., made the principal contribution to build this facility. Lehigh's Rauch Business Center was dedicated in 1990 as the state-of-the-art home of the university's College of Business. The $17.8-million facility has 115,000 square feet of floor space on five stories and features a diverse array of classrooms, auditoria, conference rooms, as well as, The Common Grounds Café, and the Perella Financial Services Lab.

Sayre Building (1869). Originally known as the Sayre Observatory, the dome that once housed the telescope can still be seen.

Sherman Fairchild Center for the Physical Sciences (1892, 1976, 1986). The center, completed with help from the Sherman Fairchild Foundation, houses classrooms and laboratories for undergraduate and graduate students in physics, faculty offices, and a 260-seat auditorium. The complex includes the Lewis Laboratory, the original five-story stone structure built in 1892, the Sherman Fairchild Laboratory for Solid-State Studies built in 1976, and the 1986 addition comprised of the Oberkotter Auditorium and research laboratories.

Sinclair Laboratory (1970). This facility houses Materials, Science & Engineering Department, Mechanical Engineering & Mechanics Department, The Center for Photonics and Nanoelectronics, The International Materials Institute, and other research laboratories. It is named for Francis MacDonald Sinclair, and was the gift of his widow, Jennie H. Sinclair. A 12,000-square foot research addition was completed in 2005.

STEPS Building (2010). This facility is the cornerstone of the new STEPS Initiative, which was founded to strengthen Lehigh's commitment to collaboration, innovation, and scholarship in the areas of science, technology, environment, policy, and society. The new 137,000-square-foot building is at the corner of Packer Avenue and Vine Street on Lehigh's Asa Packer campus. The building was designed to eliminate boundaries between the disciplines and features state-of-the-art teaching and research areas mingled with seminar rooms, study lounges, and faculty offices. The $60 million facility is the university's first "green" building having been awarded LEED gold certification (Leadership in Energy and Environmental Design). It incorporates features such as heat recovery systems, a radiant-floor heating system, an abundance of natural lighting, an automated daylight harvesting system, an Energy Star roof membrane, and an 8,000-square-foot vegetated roof. It is home to the Earth and Environmental Sciences department and the Energy Systems Engineering institute (ESEI) and contains research labs for environmental engineering and teaching labs for biological sciences and chemistry.

University Police (2014). Located at 321 East Packer Avenue, the station operates around the clock throughout the year. The department is accredited by the Pennsylvania Chiefs of Police Association and the International Association of Campus Law Enforcement Administrators.

Whitaker Laboratory (1965). This five-story structure with an adjoining two-level classroom-auditorium section honors the memory of Martin Dewey Whitaker, university president from 1946 to 1960. The building serves the Department of Materials Science and Engineering and Electrical & Computer Engineering. There are laboratories for high-pressure research and reaction kinetics, nuclear studies, analog computation, process control, optoelectronics, high-temperature thermodynamics and kinetics, and fine structures and metallography. The Baker Institute for Entrepreneurship, Creativity, & Innovation is located on the first floor.

Wilbur Powerhouse (1908). During most of its life, the building served as a power plant with some early engineering laboratory use. Renovated during the 1970s, it provided performing space for student theatrical productions, until the Zoellner Arts Center was built. It is now the new home for student shops and project studios serving as the hub of interdisciplinary programs on campus that is designed to give students and faculty tools and resources to go from idea to physical concept.

Williams Hall (1903). This brick structure was the gift of Edward H. Williams, Jr., Class of 1875. Dr. Williams was a professor of mining and geology and the founder of the Tau Beta Pi engineering society. The building was extensively renovated and a fourth story added in 1956 following a fire. Summer 2015 brings a refurbished and repurposed historical Williams Hall that reinforces the integration of academic programs and student support. It is a global hub for the Lehigh community complete with a Global Commons, a Global Cafe, as well as departments of modern languages and literature, and political science. Williams Hall is the university's second "green building" and attained Silver LEED certification upon completion.

Zoellner Arts Center (1997). With major gifts from Vickie and Robert Zoellner '54, Dorothy and Dexter Baker '50, and Claire and Theodore Diamond '37, Dagit-Saylor Architects created a 105,000-sq.-ft. structure designed to showcase Lehigh's rapidly growing programs in the performing and visual arts as well as the departments of music and theatre and 5,000 sq. ft. of exhibition space for the Lehigh University Art Galleries. Baker Hall has a seating capacity of more than 1,000, Diamond Theatre features a thrust stage and seating for 307; and a "black box" theater provides flexible space for experimental productions.

Athletic and Convocational Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Taylor Gymnasium (1904 and 1913). This structure was the gift of Charles L. Taylor, Class of 1876, who was a friend and business associate of steel magnate Andrew Carnegie. There are two indoor swimming pools, two basketball courts, the Welch Fitness Center, men's and women's locker rooms, two racquetball and two squash courts, a multipurpose dance/aerobics room, a dance studio, a dance/spin studio, a climbing wall, a Sports Medicine Complex, and the Penske Hall of Fame. The athletic department offices are also housed in the Warren (Pete) Musser wing.

Grace Hall (1940 and 2013). The building is named for its donor, Eugene G. Grace, Class of 1899, who was chairman of Bethlehem Steel Corp. and president of the university's board of trustees, 1924 to 1956. Grace Hall serves as the headquarters and offices for Lehigh intramural and club sports. The lower level houses the Leeman-Turner Arena, and the upper level houses the recently renovated Caruso Wrestling Complex.

Sayre Field (1961). Located atop South Mountain, the field is used for intramural sports.

Cundey Varsity House (1963; expanded in 2002 & 2015). The building, expanded and renovated in 2002, houses a modern weight training facility, sports medicine and equipment areas, team meeting and reception areas, and locker rooms for several varsity teams. The Varsity House is located on the Murray H. Goodman Campus adjacent to the John C. Whitehead Football Practice Facility. The 2015 expansion of the west side of the building will accommodate Lehigh's growing athletic programs to better serve the student-athletes.

Philip Rauch Field House (1976). Philip Rauch '33, L.L.D. '79, made a gift toward the facility. The building has 62,000 square feet of uninterrupted floor space, the equivalent of two football fields, for

a variety of athletic and non-athletic activities. It has a six-lane, one-eighth-mile flat track.

Stabler Athletic & Convocation Center (1979). This arena provides seating for 6,000 people for concerts, spectator sports, including Lehigh's basketball teams, and other events. University trustee Donald B. Stabler '30 made a major financial contribution toward the facility.

Murray H. Goodman Stadium (1988, 2019). Joanie and Murray Goodman '48, L.L.D. '88, were the principal benefactors. On October 1, 1988, Lehigh opened the gates to Murray H. Goodman Stadium, located on the Goodman Campus with picturesque South Mountain in the background. Capacity is 16,000, and the stadium features a three-tiered press box, limited chair back seating, and a newly constructed VIP Suite

Lewis Tennis Facility (1994). An anonymous donor made possible the construction of four indoor tennis courts for recreational use as well as team practice, and is named for former Lehigh President W. Deming Lewis. The building also includes men's and women's locker room facilities.

Ulrich Sports Complex (1999; expanded in 2009 & 2015). Lehigh chairman of the board of trustees, Ronald J. Ulrich '66, provided the principal funding for the construction of a multi-field game complex used for men's and women's soccer, men's and women's lacrosse, and field hockey. The complex features a natural grass and two artificial surface fields: Frank Banko Field and Ronald J. Ulrich Field. The complex has permanent seating, press boxes, and lighting for night contests. A group of students enrolled in the University's distinctive ILE (Integrated Learning Experience) program collaborated in the design of the original complex, illustrating the strong partnership between athletics and academics at Lehigh. The new Gould Shenfeld Half-Time building (2015) is a place for the competing teams to meet at halftime as well as pre and post game.

Mulvihill Golf Learning Center (2007). A USGA Qualified Training Facility with a driving range with five target greens, large practice green, and chipping green with three sand bunkers. The indoor facility houses a 672 square foot practice green and three indoor driving range bay providing year round training for the Men's and Women's Golf programs.

Leadership Field, New Softball Field Complex (2015). Located near the Goodman campus entrance, the complex includes a new playing field, video platforms, modern stands, enhanced dugouts, bullpens, batting cages, and a press box.

J. David Walker Field at Legacy Park, Baseball Field Complex (2015). This newly renovated baseball includes larger and enhanced dugouts, a synthetic infield and a natural grass outfield, bullpens and batting cages, modern stands, a press box, and a cable and netting system.

Residential Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Brodhead House (1979). This structure is the university's first high-rise residential facility. The six-story building includes 4-person suites on the five upper floors, with a dining facility and lobby on the entrance level. The building is named in memory of Albert Brodhead, a member of the Class of 1888 who died in 1933, leaving 51 Bethlehem properties to his alma mater.

Farrington Square (2002). In August of 2002, Lehigh opened a 250-bed residential complex that includes the campus bookstore, the university post office, and several retail stores. Air-conditioned, two-, three-, and four-bedroom apartments are complete with full kitchen, private bathroom and fully furnished living room/dining room areas. Attached to the complex is a parking garage for 350 cars for residents' convenience.

Dravo House (1948). This 5-story stone edifice is the university's largest residential facility. It bears the name of two brothers, Ralph M. Dravo, Class of 1889, and Francis F. Dravo, Class of 1887, who founded the Dravo Corp., a Pittsburgh-based international construction company. Both men served as university trustees.

Drinker House (1940). This stone building honors the memory of Henry S. Drinker, Class of 1871, university president from 1905 to 1920.

Hitch House (2021) Hitch House is part of a three building (Singleton, Hitch, Maida) residence hall complex for second year and upper class students. This residence hall complex is all-gendered, houses 405 students in air-conditioned suites, and includes a fitness center and café. Hitch House is named after Julie '20P '21P and Jordan Hitch '88 '20P '21P.

Maida House (2021) Maida House is part of a three building (Singleton, Hitch, Maida) residence hall complex for second year and upper class students. This residence hall complex is all-gendered, houses 405 students in air-conditioned suites, and includes a multipurpose studio. Maida House is named after Sharon and James Maida '85 '17P '19P.

McClintic-Marshall House (1957). This U-shaped stone structure was built in memory of Howard H. McClintic and Charles D. Marshall, both Class of 1888, who founded the McClintic-Marshall Construction Co. The firm was the world's largest independent steel fabricating firm before its acquisition by Bethlehem Steel Corp. in 1931. It built locks for the Panama Canal and constructed the Golden Gate Bridge in San Francisco Bay.

Packer House The Graduate Student Center and Office of Graduate Life moved here in the summer of 2009, offering multipurpose social programming and meeting space for graduate students.

Richards House (1938). The building honors the memory of Charles Russ Richards, president of the university from 1922 to 1935. The building is constructed of stone in modified Gothic design.

Sayre Park Village (1998). This residential complex is comprised of three apartment buildings and houses students in three- and four-person apartments. Included is a fourth multipurpose community building and outdoor recreation facilities.

Singleton House (2021) Singleton House is part of a three building (Singleton, Hitch, Maida) residence hall complex for second year and upper class students. This residence hall complex is all-gendered and houses 405 students in air-conditioned suites. Singleton House is named after Charlot and Dennis Singleton '66.

Taylor House (1907, 1984). The U-shaped building is one of the earliest concrete structures ever built. It was the gift of industrialist Andrew Carnegie in honor of his friend and associate, university trustee Charles L. Taylor, Class of 1876. The interior of the building was reconstructed and the exterior refinished prior to the facility becoming Lehigh's first residential college in 1984.

Trembley Park (1975). This seven-building undergraduate apartment complex is named in memory of Francis J. Trembley, Lehigh professor and pioneer ecologist.

Umoja House. The Umoja House was established in 1989 to enhance the campus atmosphere for underrepresented students at Lehigh. The U House offers a safe and comfortable environment for any student who values multiculturalism.

Warren Square Complex. This cluster of four residence halls is located on Warren Square and Summit Street. They are upperclass facilities and some are used as special-interest houses.

CENTENNIAL I COMPLEX (1965)

Congdon House. Located at the east end of the Centennial I complex. Dr. Wray H. Congdon served as dean of students, dean of the graduate school, and special assistant to the president.

Emery House. It is named for Dr. Natt M. Emery, who was vice president and controller.

Leavitt House. The Rev. Dr. John McD. Leavitt was the second president, 1875 to 1879.

McConn House. C. Maxwell McConn was dean of the university from 1923 to 1938.

Smiley House. Dr. E. Kenneth Smiley served as vice president from 1945 to 1964.

Thornburg House. Dr. Charles G. Thornburg was professor and head of the Department of Mathematics, 1895 to 1923

CENTENNIAL II COMPLEX (1970)

Beardslee House. Dr. Claude G. Beardslee was chaplain from 1931 to 1947.

Carothers House. Dr. Neil Carothers was dean of business.

Palmer House. Dr. Philip M. Palmer was dean of the arts.

Stevens House. The Rt. Rev. William Bacon Stevens, of Philadelphia, was Protestant Episcopal bishop of the Diocese of Pennsylvania and first president of the university board of trustees. He was the principal architect of the university's original academic plan.

Stoughton House. Dr. Bradley Stoughton was dean of the engineering college, 1936 to 1939.

Williams House. Dr. Clement C. Williams was president of the university, 1935 to 1944.

SAUCON VILLAGE APARTMENTS (1974)

The five-building garden apartment complex includes housing for married, graduate, and undergraduate students.

Diamond. Dr. Herbert M. Diamond, professor emeritus of economics, retired in 1964.

Gipson. Dr. Lawrence Henry Gipson, research professor of history, bequeathed his estate to the university to establish the Lawrence Henry Gipson Institute for Eighteenth-Century Studies. Dr. Gipson wrote a monumental 15-volume history, *The British Empire before the American Revolution* . He won the Pulitzer Prize for volume 10, *The Triumphant Empire: Thunderclouds Gather in the West, 1763-1766.*

Hartman. Dr. James R. Hartman was chairman of the department of mechanical engineering and mechanics.

More. Dr. Robert P. More '10, dean of the College of Arts and Sciences, who also taught German for forty years, bequeathed to the university his $746,000 estate, amassed after investing $3,000 in IBM stock. The university child care center is located in this building.

Severs. Dr. J. Burke Severs, of Bethlehem, is distinguished professor emeritus of English. He is a Chaucerian scholar.

FRATERNITIES AND SORORITIES

The university has a strong fraternity tradition, dating back to 1872. Since the admission of undergraduate women in 1971, several sororities have come into being. Some 400 men live in 10 fraternities.

All of the fraternities have houses located on Asa Packer campus. All are chapters of national fraternities.

An alphabetical listing follows. The date of the founding of the chapter is given in the first column. The second column lists the date the chapter occupied its present house; any additional date indicates the most recent addition or major renovation.

Fraternity	Chapter Founded	Present House Occupied	Recent Addition or Renovation
Alpha Tau Omega	1882		
Chi Phi	1872	1923	1968
Chi Psi	1893	1915	2005
Delta Chi	1952	2015	
Delta Upsilon	1885	1968	
Phi Delta Theta	1879	2015	
Phi Sigma Kappa	1901	1956	1970
Psi Upsilon	1884	1909	1966
Sigma Phi Epsilon	1907	1963	
Theta Chi	1942	1964	

There are nine sororities and all are nationally affiliated. Over 380 women live in sororities.

The sororities are listed with year of establishment at Lehigh in the first column and year of moving into their present house in the second column.

Sorority	Establishment at Lehigh	Present House Occupied
Alpha Epsilon Pi	2019	2019
Alpha Gamma Delta	1975	2000
Alpha Omicron Pi	1983	2004
Alpha Phi	1975	1996
Gamma Phi Beta	1975	1998
Kappa Alpha Theta	1984	2006
Kappa Delta	2013	2013
Pi Beta Phi	1997	2008
Zeta Tau Alpha	2010	2011

Administration and Staff

This section lists the people whose talents and abilities constitute the university's most important resource. Members of the board of trustees contribute their expertise to establish the policies of the university. Also listed are the administration and the members of the faculty and staff.

Board of Trustees

For information on Members of the Board of trustees, please refer to this Link: https://www1.lehigh.edu/trustees **(**https://www1.lehigh.edu/trustees/**)**

Principal Officers

The highest degree earned is given here. All offices, unless otherwise noted, are located at Bethlehem, PA 18015; the area code, unless otherwise noted, is (610).

PRINCIPAL OFFICERS

Joseph J. Helble, Ph.D., president; 758-3156

Nathan N. Urban, Ph.D., provost and senior vice president for academic affairs; 758-3605

Brett Ludwig, B.S., vice president for communications and public affairs; 758-3171

Frank A. Roth, J.D., general counsel, secretary to the board; 758-3572

Carol Packard, M.Ed., vice president for development and alumni relations; 758-2586

Erik J. Walker, M.A., chief of staff, Office of the President; 758-3131

Mike Todd, M.B.A., vice president for finance and administration; 758-3178

Ricardo Hall, Ph. D., vice provost for student affairs; 758-3890

Anand Jagota, Ph.D., vice provost for research; 758-5212

Joseph D. Sterrett, Ed.D., Murray H. Goodman dean of athletics; 758-4320

Kristin Agatone, M.B.A., chief investment officer; 758-3034

Cheryl Ann Matherly, Ed.D., vice president and vice provost for international affairs; 758-4709

Manoj Malhotra, Kevin L. and Lisa A. Clayton dean, College of Business; 758-6725

Robert Flowers, Ph.D., Herbert J. and Ann L. Siegel dean, College of Arts and Sciences; 758-3300

William Gaudelli, Ph.D., dean, College of Education; 758-3221

Stephen DeWeerth, Ph.D., dean, P.C. Rossin College of Engineering and Applied Science; 758-4025

Beth Dolan, Ph.D., dean, College of Health; 758-1888

Terry-Ann Jones, Ph.D., deputy provost for undergraduate education; 758-5954

Sabrina Jedlicka, Ph.D., deputy provost for graduate education; 758-4425

Dan Warner, B.S., vice provost of admissions and financial aid; 758-3100

Greg Reihman, Ph.D., vice provost for library and technology services; 758-3025

Donald Outing, Ph.D., vice president for equity and community; 758-3133

Yenny Anderson, Ed.D., vice provost for institutional research; 758-5890

Khanjan Mehta, Ph.D., vice provost for creative inquiry and director of Mountaintop Initiative; 758-4568

College Offices

College of Arts and Sciences
Maginnes Hall
9 West Packer Avenue; 758-3300
Robert A. Flowers, Ph.D., Herbert J. and Ann L. Siegel Dean
Dawn Keetley, Ph.D., associate dean, faculty affairs
R. Michael Burger, Ph.D., associate dean, research and graduate programs
Kelly Austin, Ph.D., associate dean, undergraduate programs
Jessecae Marsh, Ph.D., associate dean, interdisciplinary programs

College of Business
Rauch Business Center
621 Taylor Street; 758-3000
Manoj Malhotra, Kevin L. and Lisa A. Clayton Dean
Naomi Rothman, Ph.D., associate dean and director, undergraduate programs
Xiaosong (David) Peng, Ph.D., associate dean, graduate programs

College of Education
Iacocca Hall
111 Research Drive; 758-3221
William Gaudelli, Ph.D., dean
George DuPaul, Ph.D., associate dean for research
Robin Hojnoski, Ph.D., associate dean for graduate studies

College of Health
HST Building
124 East Morton Street; 758-1800
Beth Dolan, Ph.D., dean
Michael Gusmano, Ph.D., associate dean for academic programs
Won Choi, Ph.D., M.P.H., associate dean for research and graduate studies Erica Hoelscher, MFA, associate dean for faculty and staff

P.C. Rossin College of Engineering and Applied Science
Packard Laboratory
19 Memorial Drive West; 758-4025
Stephen DeWeerth, Ph.D., dean
Susan Perry, Ph.D., assistant dean for academic affairs
Derick Brown, Ph.D., associate dean for undergraduate education Mark Snyder, Ph.D., associate dean for graduate education
John Coulter, Ph.D., senior associate dean for research
Kristen Jellison, Ph.D., associate dean for faculty development

Offices and Resources

In this section, only the principal officers are listed.

Admissions
27 Memorial Drive West; 758-3100
Dan Warner, vice provost for admissions and financial aid

Advancement (see Development and Alumni Relations)

Alumni Association
27 Memorial Drive West; 758-5799
Jennifer Cunningham, assistant vice president, alumni engagement

Art Galleries/Museum Operations
420 East Packer Avenue; 758-4862
William B. Crow, director/curator

Athletics
641 Taylor Street; 758-4300
Joseph D. Sterrett, Murray H. Goodman dean of athletics

Auxiliary Services
306 S. New St., Suite 428; 758-3843
Mark R. Ironside, associate vice president

Ben Franklin Technology Center
116 Research Drive; 758-5200
Angelo Valletta, president and CEO

Bookstore

9 West Packer Avenue; 758-3383
Renee Lutz, general manager

Budget Office
618 Brodhead Avenue; 758-5097
Warren J. Loller, director

Bursar
27 Memorial Drive West; 758-3160
Gina McCormick, bursar

Career Services
9 West Packer Avenue, Suite 500; 758-4665
Lori Kennedy, senior director

Center for Gender Equity
29 Trembley Drive; 758-6484
Rita Jones, director

Chaplaincy Services
661 Taylor Street; 758-3877
Rev. Dr. Lloyd H. Steffen, university chaplain

Child Care Center - Bright Horizons
5 Duh Drive; 758-5437
Julie Harrington, director

Community and Regional Affairs
343 Whitaker Lab, 5 E. Packer; 758-5801
Adrienne Washington, assistant vice president, community relations

Computing Center (see Library and Technology Services)

Conference Services
63 University Drive, Rathbone Hall; 758-5306
Mary Kay Baker, director

Controller's Office
524 Brodhead Avenue; 758-3140
Steve Crouch, controller

Corporate & Foundation Relations
306 S. New St., Suite 500; 758-5154
Ed Clarke, executive director

Counseling & Psychological Services
36 University Drive; 758-3880
Aaron Sterba, clinical director

Dean of Students
29 Trembley Drive, C108 University Center; 758-4156
Ricardo Hall, vice provost for student affairs

Development and Alumni Relations
306 South New Street, Suite 500; 758-2586
Carol Packard, vice president

Distance Education (see Special Academic Programs)

Environmental Health and Safety
616 Brodhead Avenue; 758-4251
Elaine Kuchera and Randy Shebby, assistant directors

Facilities Services and Planning
681 Taylor Street; 758-3940
Nancy Trainer, associate vice president

Finance and Administration
27 Memorial Drive West; 758-3178
Mike Todd, vice president

Financial Aid
218 W. Packer Avenue; 758-3181
Jennifer Mertz, director

Fraternity and Sorority Affairs
305 Christmas-Saucon Hall; 758-4157
Sara Runyon, assistant dean

General Counsel
27 Memorial Drive West, Room 105; 758-3572
Frank A. Roth, Esq., general counsel
Heather K. Hosfeld, Esq., deputy general counsel

Government Relations
301 Broadway, Suite 301; 758-5802
Christopher Carter, associate vice president; 758-6597
Geoffrey Mock, J.D., associate director; 758-5424

Graduate Student Life
217 W. Packer Ave.; 758-4722
Kathleen S. Hutnik, director

Health & Wellness Center
36 University Drive, Johnson Hall; 758-3870
Steven Bowers, D.O., medical director

Human Resources
306 S. New St., Suite 437; 758-3900
Chris Halladay, associate vice president

Institutional Research
27 Memorial Drive West, Room 308; 758-5890
Yenny Anderson, associate vice president

Internal Audit
616 Brodhead Avenue; 758-5012
Mark Laccetti and Adrienne Larmett

International Affairs
32 Sayre Drive, Coxe Hall; 758-4709
Cheryl Ann Matherly, vice president and vice provost

Library and Technology Services
8A East Packer Avenue; 758-3025
Greg Reihman, vice provost

Police (see University Police)

President's Office
27 Memorial Drive West; 758-3156
Joseph J. Helble, president

Provost's Office
27 Memorial Drive West; 758-3605
Nathan N. Urban, provost and senior vice president for academic affairs

Purchasing
306 S. New St., Suite 428; 758-4637
Jane Altemose, director

Registrar
27 Memorial Drive West; 758-3200
Michael Dills-Allen, university registrar

Research
27 Memorial Drive West; 758-5212
Anand Jagota, vice provost

Research and Sponsored Programs
526 Brodhead Avenue; 758-3021
Cynthia J. Kane, assistant vice provost
Susan E. Disidore, associate director

Residential Services
63 University Drive, Rathbone Hall; 758-3500
Ozzie Breiner, director

Risk Management
616 Brodhead Ave.; 758-3899
Kim Nimmo, director

Special Academic Programs (Distance Education and Summer Studies)
436 Brodhead Avenue; 758-3966 (summer); 758-4373 (distance)

Sports Communications
641 Taylor Street; 758-3174
Steve Lomangino, director

Student Affairs
29 Trembley Drive, University Center; 758-3890
Ricardo Hall, vice provost

Student Auxiliary Services
63 Rathbone Hall; 758-5339
David M. Joseph, executive director

Summer Studies (see Special Academic Programs)

Transportation and Parking Services
622 Brodhead Avenue; 758-7275
Sharon Field, director

Treasurer (see Finance and Administration)

University Communications and Public Affairs
301 Broadway, 4th floor, Suite 400; 758-4487
Brett Ludwig, vice president

University Police
321 East Packer Avenue; 758-4200
Jason D. Schiffer, chief

Writing & Math Center
110 Drown Hall; 758-4525
Edward Lotto, director

Zoellner Arts Center
420 East Packer Avenue; 758-5323
Mark Wilson, executive director

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