SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE UNIVERSITY
DELHI NCR

DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF ENGINEERING (SoE)

UNDERGRADUATE PROSPECTUS

(2022 onwards)

FOR
CIVIL ENGINEERING DEPARTMENT (CED)
https://www.snu.edu.in/schools/school-of-engineering/departments/department-of-civil-engineering/

CONTENT

About Shiv Nadar Institution of Eminence Delhi-NCR

Shiv Nadar Institution of Eminence (SNIoE) is a comprehensive, multidisciplinary, research-focused and student-centric institution that is bringing a paradigm shift in higher education in India through its innovative curriculum, interdisciplinary focus, and cross-disciplinary thinking across a wide range of disciplines. The University is building an eco-system of knowledge to promote recognition of the inter-connectedness of ideas, systems, and environments in the world inside the campus, and those outside it. The University has 5 Schools, 23 Departments and 3 Research Centers engaged in teaching, practice, and research in disciplines as diverse as Engineering, Humanities & Social Sciences, Management, Natural Sciences, Academy of Continuing Education, Art, Design, Performing Arts, Communication, and Extended Education & Professional Development. The Schools offer Bachelor, Master's, and Doctoral degrees along with multidisciplinary curriculum to enable students to explore subjects and disciplines that may be widely different from their chosen Majors.

1. **The University has recently been chosen as one of the select ten private "Institutions of Eminence (IOE)" by the Government of India.**

2. **In the NIRF (Government's National Institutional Ranking Framework), SNU has been the youngest institution in the 'top 100' Overall list. SNU ranked 61 in the University category, and 94 'Overall' in NIRF 2022.**

3. **The University has been accredited with 'A' Grade by the National Assessment and Accreditation Council (NAAC), valid for a period of 5 years from 26 November 2019.**

4. **SNU is also among a select group of green-field institutions in the country, which were awarded the prestigious Atal Incubation Center grant by the Niti Aayog, Government of India, in the very first round in 2017.**

About the Department

The Department of Civil Engineering at Shiv Nadar Institution of Eminence (SNIOE) is determined to develop scientific rigor and professional expertise in its undergraduate (B. Tech.) and postgraduate (Ph.D.) students through our wide spectrum of core and elective courses, and to train them as skilled, dynamic, and critical thinkers who can lead the country's development from the forefront. The curriculum for the Programs in the Department is designed to produce high quality professionals who can meet industry requirements, including in leading research and development (R & D) organizations and academic institutions, as well as, to prepare them for their entrepreneurship visions. The department follows a one-of-a-type UG and PhD curriculum to create strong learning focus on emerging and disruptive technologies and integrates cyber-physical systems to achieve Sustainable Development Goals (SDGs) into their learning environment by including courses on Sustainability, Machine Learning (ML), Internet of Things (IoT) and Remote Sensing (RS) along with core subjects at UG and Ph.D. levels. The Department of Civil Engineering has 13 well-experienced faculty members with Ph.D. degrees from various IITs / universities from abroad offering different academic specializations.

The thrust areas of the department are

SUSTAINABLE INFRASTRUCTURE SYSTEMS	WATER, ENVIRONMENT, AND CLIMATE	URBAN NETWORK SYSTEMS

Know Your Faculty

ATRI NATH
(Assistant Professor), PhD IIT Kharagpur.
Specialization: Structural Engineering, Computational mechanics, Steel structures, fatigue and fracture, Material modelling
Office Location: C322A
Email Id: atri.nath@su.edu.in

ELLORA PADHI
(Assistant Professor), PhD IIT Kharagpur.
Specialization: Water Resources Engineering, Turbulence in open channel flow, Sediment transport phenomena, River meandering.
Office Location: C322C
Email Id: ellora.padhi@su.edu.in

GHANSHYAM PAL
(Associate Professor), PhD University of Mississippi, USA.
Specialization: Structural Engineering, Building physics and sustainability, Novel cementitious composites, Multiscale numerical modelling.
Office Location: C121H
Email Id: ghanshyam.pal@su.edu.in

GOPAL DAS SINGHAL
(Associate Professor & Associate Head), PhD IIT Roorkee.
Specialization: Water Resources Engineering, Hydraulic structures, River hydraulics, Smart agricultural water management.
Office Location: C121J
Email Id: gopal.singhal@su.edu.in

GURMAIL BENIPAL
(Professor), PhD IIT Delhi. Specialization: Structural Engineering, Constitutive modelling and structural theory, Damage elasto-plasticity and Thermo-chemo-visco-elasticity of concrete, Chaos and stability of structures.
Office Location: C322E
Email Id: Gurmail.benipl@su.edu.in

GYAN VIKASH
(Associate Professor & Head), PhD IIT Kanpur.
Specialization: Geotechnical Engineering, Computational geomechanics, Constitutive modeling of geomaterials, Physics based - data driven modeling in geomechanics.
Office Location: C121L
Email Id: gyan.vikash@su.edu.in

HITESH UPRETI
(Assistant Professor), PhD IIT Roorkee.
Specialization: Water Resources Engineering, Evapotranspiration, Remote sensing in agriculture and water resources, Smart agricultural water management, Irrigation hydrology.
Office Location: C121K
Email Id: hitesh.upreti@su.edu.in

JAGABANDHU DIXIT
(Associate Professor), PhD IIT Bombay.
Specialization: Earthquake Engineering and Structural Dynamics, Natural hazards and disaster risk reduction, Disaster mitigation and emergency management.
Office Location: C322H
Email Id: jagabandhu.dixit@su.edu.in

MANOJ KUMAR SINGH
(Assistant Professor), PhD IIT Delhi.
Specialization: Structural Engineering, Adaptive thermal comfort, Occupant's behavior and built energy interaction, Building energy simulation, High-performance building envelopes.
Office Location: C322B
Email Id: manoj.singh@su.edu.in

SAILESH NARAYAN BEHERA
(Associate Professor), PhD IIT Kanpur.
Specialization: Environmental Engineering, Air quality monitoring and aerosol modeling, Policy evaluation of pollution control strategies, Pollution scenarios with water-air-soil interactions.
Office Location: C322F
Email Id: sailesh.behera@su.edu.in

SHALINI RANKAVAT
(Assistant Professor), PhD IIT Delhi.
Specialization: Transportation Engineering, Transport planning and policy, Traffic safety, Public transport and NMV planning.
Office Location: C121M
Email Id: shalini.rankavat@su.edu.in

SUMEDHA MOHARANA
(Associate Professor), PhD IIT Delhi.
Specialization: Structural Engineering, Piezoelectric impedance based structural health monitoring, Smart materials, Building science.
Office Location: C121G
Email Id: sumedha.maharana@su.edu.in

SUSANT KUMAR PADHI
(Assistant Professor), PhD IIT Guwahati.
Specialization: Environmental Engineering, Biological & physico-chemical processes in environmental engineering, Membrane technology for wastewater treatment, Solid waste management.
Office Location: C322D
Email Id: susant.padhi@su.edu.in

CED Laboratory

The Department of Civil Engineering has many well-equipped laboratories for training our UG and Ph.D. students and conducting research work. In addition, the Institution has established several centralized facilities for the researchers with sophisticated research equipment e.g. Scanning electron microscope (SEM), Metallic 3D printer, Energy dispersive X-Ray spectroscopy (EDX), Differential scanning calorimeter (DSC), etc.

UG TEACHING LABORATORIES:

- Civil Engineering Computing Laboratory
- Concrete Technology Laboratory
- Environmental Engineering Laboratory
- Fluid Mechanics Laboratory
- Hydraulics Laboratory
- Soil Mechanics Laboratory
- Strength of Materials Laboratory
- Survey and Geoinformatics Laboratory
- Transportation Engineering Laboratory

PG RESEARCH LABORATORIES:

- Advance Materials and Building Energy Laboratory
- Air Quality Laboratory
- Air Sampling Laboratory
- Civil Engineering Computing Laboratory
- Disaster Management Laboratory
- Intelligent Geosystems Laboratory
- Water Management Field lab
  (Agriculture Water Management Laboratory and River Engineering Laboratory)

Details of Laboratory Staff

SURENDRA K. SHARMA
Surendra.Sharma@snu.edu.in

JITENDRA K. TRIPATHI
jitendra.tripathi@snu.edu.in

RAJNEESH KUMAR
rajneesh.kumar@snu.edu.in

RAJU GUPTA
rg868@snu.edu.in

Table 1: Details of Laboratory with Assigned Staff and Location

Name of the lab	Staff Lab in-charge	Lab Location
Civil Engineering Computing Lab	Mr. Raju Gupta	C 116
Air Pollution lab	Mr. Surendra Sharma	C 118
Geoinformatics	Mr. Jitendra Tripathi	C 109
AMBE lab	Mr. Jitendra Tripathi	D 117A
Experimental Soil Mechanics	Mr. Raju Gupta	C 014B
Environment Engineering lab	Mr. Jitendra Tripathi	C 017
Intelligent Geosystems Lab	Mr. Raju Gupta	C 014A
Fluid Mechanics	Mr. Rajneesh	C 013A
Hydraulic lab	Mr. Rajneesh	C 009
Strength of Material Lab	Mr. Raju Gupta	C 006
Concrete lab	Mr. Surendra Sharma	F 001
Transportation Engineering Lab	Mr. Surendra Sharma	F 101
Water Management Field Lab	Mr. Rajneesh	Field lab
Disaster Management Lab		C 310

Undergraduate Program in CED

The Department develops scientific rigor and professional expertise in undergraduate students through its broad spectrum of core and elective courses dispersed throughout the Bachelor of Technology (B.Tech.) coursework. The undergraduate curriculum will mold students into excellent professional engineers by training them in different aspects of Civil engineering through modern technological, analytical, and computational courses. The curriculum encompassing courses from Common Core Curriculum (CCC), University-Wide Electives along with Major electives provide the student a nurturing atmosphere to follow their passion after graduation, be it in industry, governmental position, research or in their entrepreneurship journey.

The department offers B. Tech. level specializations in the areas of

(I) Sustainable Infrastructure Systems

(II) Water, Environment, and Climate

(III) Urban Network Systems.

UG students also have scope to obtain Bachelor of Technology in Civil Engineering (B.Tech. in CE) with the option of doing minor in any other stream of interest.

A. Credit Break-up of UG Curriculum in Civil Engineering (CE) Courses (Major in Civil Engineering)

Table 2: Overall Credit Distribution

S. No.	Category	Credits
1	Core Common Curriculum (CCC)	18
2	University-Wide Elective (UWE)	18
3	CCC and/or UWE	6
4	Basic Sciences (BS)	17
5	Engineering Sciences (ES)	18
6	Sensing and Data Analytics	12
7	Major Core	47
8	Major Elective	12
9	Project	12
Total Credits		160

Table 3: Semester-wise Credit Distribution

S. No.	Category	Credits
1	Semester I	19
2	Semester II	20
3	Semester III	22
4	Semester IV	20
5	Semester V	21
6	Semester VI	22
7	Semester VII	21
8	Semester VIII	15
Total Credits		160

Table 4: Basic Sciences for CE

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
1	MAT 103	Mathematical Methods-I	3:1:0	4	1
2	PHY 101	Physics-I	3:1:0	4	1
3	MAT 104	Mathematical Methods-II	3:1:0	4	2
4	PHY 103	Physics-II	3:1:1	5	2
Semester Credits				17	

Table 5: Engineering Sciences for CE

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
1	CSD 101	Introduction to Computing & Programming	3:1:0	4	2
2	CED 101	Engineering Mechanics	3:1:0	4	2
3	CED 102	Engineering Graphics	1:0:1	2	1
4	CED 215	Mechanics of Solids	3:0:1	4	3
5	CED 216	Mechanics of Fluid	3:0:1	4	3
Semester Credits				18	

Table 6: Sensing and Data Analytics Courses

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
1	CED 217	Computational Methods	2:0:1	3	3
2	CED 218/ CED 221	Risk and Reliability Analysis/ System Analysis in Civil Engineering	3:0:0	3	4
3	CED 310/ CED 322	Introduction to Remote Sensing and GIS/ Sensors and IOT for Civil Engineering	2:0:1	3	5
4	CED 323/ CED 324	Machine Learning for Civil Engineering/ Introduction to Data Analytics	3:0:0	3	6
Semester Credits				12	

Table 7: Major Electives for CE

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
1	***	Major Elective – I	3:0:0	3	6
2	***	Major Elective – II	3:0:0	3	7
3	***	Major Elective – III	3:0:0	3	7
4	***	Major Elective – IV	3:0:0	3	8
Semester Credits				12	

Table 8: Project for CE

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
1	CED 444	Project – I	0:0:6	6	7
2	CED 419	Project – II	0:0:6	6	8
Semester Credits				12	

Detailed rules and regulations regarding B.Tech. Program in SNU can be found in UG handbook (Available at: https://snulinks.snu.edu.in/snuPolicies/students/)

B. Semester-wise Course Distribution for CE (Major)

Table 9: First Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		CCC	***	3
2		CCC	***	3
3	MAT 103	Mathematical Methods-I	3:1:0	4
4	PHY 101	Physics-I	3:0:1	4
5	CED 102	Engineering Graphics	1:0:1	2
6	CED 104	Civil Engineering Systems & Sustainability	3:0:0	3
Semester Credits				19

*** Credit distribution varies as per the course under consideration.

Table 10: Second Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		CCC	***	3
2	MAT 104	Mathematical Methods-II	3:1:0	4
3	PHY 102	Physics-II	3:1:1	5
4	CED 101	Engineering Mechanics	3:1:0	4
5	CSD 101	Introduction to Computing and Programming	3:0:1	4
Semester Credits				20

*** Credit distribution varies as per the course under consideration.

Table 11: Third Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		UWE	***	3
2		CCC/UWE	***	3
3	CED 206	Elements of Surveying	2:0:1	3
4	CED 214	Building Information Modeling (BIM)	1:0:1	2
5	CED 215	Mechanics of Solids	3:0:1	4
6	CED 216	Mechanics of Fluid	3:0:1	4
7	CED 217	Computational Methods	2:0:1	3
Semester Credits				22

*** Credit distribution varies as per the course under consideration.

Table 12: Fourth Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		UWE	***	3
2		CCC/UWE	***	3
3	CED 203	Engineering Hydrology	2:0:0	2
4	CED 207	Hydraulic Engineering	2:0:1	3
5	CED 218	Risk and Reliability Analysis	3:0:0	3
6	CED 219	Concrete Technology	2:0:1	3
7	CED 220	Structural Analysis	3:0:0	3
Semester Credits				20

*** Credit distribution varies as per the course under consideration.

Table 13: Fifth Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		UWE	***	3
2		CCC/UWE	***	3
3	CED 304	Transportation Engineering - I	3:0:1	4
4	CED 305	Design of RCC Structures	3:0:0	3
5	CED 310	Introduction to Remote Sensing and GIS	2:0:1	3
6	CED 325	Geotechnical Engineering	2:0:1	3
7	CED 326	Water Resource Engineering	2:0:0	2
Semester Credits				21

*** Credit distribution varies as per the course under consideration.

Table 14: Sixth Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		CCC/UWE	***	3
2		Major Elective –I	3:0:0	3
3	CED 306	Foundation Analysis and Design	3:0:0	3
4	CED 308	Environmental Engineering	3:0:1	4
5	CED 327	Sustainable and Resilient Infrastructure	3:0:0	3
6	CED 323	Machine Learning for Civil Engineering	3:0:0	3
7	CED 401	Design of Steel Structures	3:0:0	3
Semester Credits				22
*** Credit distribution varies as per the course under consideration.				

Table 15: Seventh Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		UWE	***	3
2		UWE	***	3
3		Major Elective -II	3:0:0	3
4		Major Elective-III	3:0:0	3
5	CED 424	Estimation, Costing and Project Management	3:0:0	3
6	CED 444	Major Project-I	0:0:6	6
Semester Credits				21

*** Credit distribution varies as per the course under consideration.

Table 16: Eighth Semester for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1		CCC/UWE	***	3
2		CCC/UWE	***	3
3		Major Elective-IV (offline/Online)	3:0:0	3
4	CED 419	Major Project II / Internship	0:0:6	6
Semester Credits				15

*** Credit distribution varies as per the course under consideration.

For CCC/UWE, students should earn total 42 credits from CCC & UWE category in 4 year duration of course with minimum of 18 credits in each category.

C. List of 'Major Core' & 'Major Elective' courses offered in Civil Engineering Department

Table 17: Major Core courses for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1	CED 104	Civil Engineering Systems & Sustainability	3:0:0	3
2	CED 206	Elements of Surveying	2:0:1	3
3	CED 214	Building Information Modeling	1:0:1	2

4	CED 203	Engineering Hydrology	2:0:0	2
5	CED 207	Hydraulic Engineering	2:0:1	3
6	CED 219	Concrete Technology	2:0:1	3
7	CED 220	Structural Analysis	3:0:0	3
8	CED 304	Transportation Engineering - I	3:0:1	4
9	CED 305	Design of RCC Structures	3:0:0	3
10	CED 306	Foundation Analysis and Design	3:0:0	3
11	CED 424	Estimation, Costing, and Project Management	3:0:0	3
12	CED 308	Environmental Engineering	3:0:1	4
13	CED 325	Geotechnical Engineering	2:0:1	3
14	CED 326	Water Resource Engineering	2:0:0	2
15	CED 327	Sustainable and Resilient Infrastructure	3:0:0	3
16	CED 401	Design of Steel Structures	3:0:0	3
Semester Credits				**47**

Table 18: Major Elective courses for CE

S. No.	Course Code	Course Title	L:T:P	Credits
1	CED 208	Building Planning and Drawing	2:0:1	3
2	CED 210	Sustainable Infrastructure	3:0:0	3
3	CED 309	Transportation Engineering – II	3:0:0	3
4	CED 310	Introduction to Remote Sensing and GIS	2:0:1	3
5	CED 311	Watershed Management	3:0:0	3
6	CED 315	Environmental Management in Industries	3:0:0	3
7	CED 402	Statistics in Engineering	1:0:2	3
8	CED 403	Pavement Design	3:0:0	3
9	CED 404	Photogrammetry and GPS	2:1:0	3
10	CED 405	Air Quality Science and Engineering	3:0:0	3
11	CED 406	Analysis of Tall Building	2:0:1	3
12	CED 407	Transportation Systems	3:0:0	3
13	CED 408	Spatial Analysis and Digital Image	2:0:1	3
14	CED 409	Geotechnical Earthquake Engineering	3:0:0	3
15	CED 411	Earthquake Engineering	3:0:0	3
16	CED413	Biological Process in Environmental	3:0:0	3
17	CED420	Building Physics	3:0:0	3
18	CED 421	Public Transport Systems	2:0:0	2
19	CED422	Transportation Law Seminar	2:0:0	2
20	CED426	Transport Infrastructure	3:0:0	3
21	CED 431	Hydropower Engineering	3:0:0	3
22	CED 432	Mechanics of Geomaterials	3:0:0	3
23	CED 433	Physio-chemical Processes Environmental Engineering	3:0:0	3
Semester Credits				**47**

D. Minor in Civil Engineering

Students from other disciplines can earn Minor in Civil Engineering after completing the following courses successfully.

Table 19: Courses for getting a Minor in Civil Engineering

S. No.	Course Code	Course Title	L:T:P	Credits	Semester Offered
Compulsory Courses (All to be taken)					
1	CED 104	Civil Engineering Systems & Sustainability	3:0:0	3	1
2	CED 206	Elements of Surveying	2:0:1	3	3
3	CED 215	Mechanics of Solid	3:0:1	4	3
4	CED 219	Concrete Technology	2:0:1	3	4
Optional Courses (At least 2 out of the six listed below. Overall credits should be between 19-21 credits)					
1	CED 216	Mechanics of Fluid	3: 0: 1	4	3
2	CED 207	Hydraulic Engineering	2: 0: 1	3	4
3	CED 304	Transportation Engineering-I	3: 0: 1	4	5
4	CED 325	Geotechnical Engineering	2: 0: 1	3	5
5	CED 306	Foundation Engineering & Design	3: 0: 0	3	6
6	CED 308	Environmental Engineering	3: 0: 1	4	6

E. Specialization for UG students

The Civil Engineering Department offers Specializations to its UG students in the following three broad specializations:

1. Sustainable Infrastructure Systems
2. Water, Environment and Climate
3. Urban Network Systems

The students will be required to take 3 courses (minimum of 9 credits) from the pool of elective courses offered in the respective area of the specialization of their choice. To complete specialization in the respective area, the students are also required to finish their 7th semester FYUP project in the same specialization area. Thus, the students will be required to complete a minimum of 15 overall credits through the course work (9 credits minimum) and FYUP project (6 credits) in the 7th semester to earn the specialization.

F. Brief description of courses offered in the UG program

1. Introduction to Physics I (PHY 101)

Mechanics: Reference frames and coordinate systems, Newton's laws of motion in vector notation, Conservation of energy, Application of Newton's laws of motion, Dynamical stability of systems: Potential energy diagram, Collisions: Impulse, conservation of energy and linear momentum, Conservation of angular momentum and rotation of rigid bodies in plane.

Thermal Physics: Averages, probability and probability distributions, Thermal equilibrium and macroscopic variables: Pressure of an ideal gas from Newton's laws - the kinetic theory of gases. Maxwell's velocity distribution, Laws of Thermodynamics and the statistical origin of the second law of thermodynamics, Application of thermodynamics: Efficiency of heat engines and air-conditioners, Thermodynamics of batteries and rubber bands.

Recommended Book (s):

1. An Introduction to Mechanics, by Kleppner and Kolenkow
2. Physics for Scientists and Engineers with Modern Physics, by J. W. Jewett, R. A. Serway
3. Fundamentals of Physics, by Resnick, Halliday and Walker
4. Feynman Lecture Series, Vol. 1

2. Introduction to Physics II (PHY 102)

Vector Calculus: Fundamental vector operations, Vector calculus: Gradient, Divergence, Curl and related fundamental theorems of vector calculus, Vector integration (line,surface and volume integrals), Divergence theorem and Stoke's theorem, Coordinate systems (Polar (2D), Spherical and Cylindrical (3D)). Electrostatics - Electric field, divergence and curl of electric fields, electric potential, Work and Energy in electrostatics, conductors and capacitors, Laplace's equation of electrostatic potential in 1, 2 and 3 dimensions, Multipole expansion of electrostatic potential, monopole and dipole terms, field due to electric dipole, polarization in dielectrics, field of a polarized object, bound charges and its physical interpretation, electric displacement vector and Gauss's law in dielectrics, definitions of permittivity, susceptibility and dielectric constant. Magnetostatics - Magnetic forces and Lorentz force law, charged particle in an electromagnetic field, magnetic field due to steady current (Biot-Savart law), Divergence and Curl of B, Ampere's law (differential and integral form), magnetic dipole, forces and torque on a current carrying loop, magnetic field due to a magnetic dipole, magnetic vector potential, effect of magnetic field on atomic orbits, magnetzation, field of a magnetized object, bound currents and their physical, interpretation, auxiliary field H, Ampere's law in magnetized materials. Electrodynamics - Electromotive force, Ohm's law, motional emf, Faraday's law of electromagnetic induction and induced electric field, self and mutual inductance, energy in magnetic fields, Maxwell's equations before and after Maxwell, displacement currents, work-energy theorem (Poynting's theorem) in electrodynamics, Poynting's vector, continuity equation, electromagnetic waves in vacuum, monochromatic plane electromagnetic waves and their representation. Wave Optics: Interference of light waves: Young's double slit experiment, displacement of fringes, Interference in thin films. Diffraction: Fresnel's and Fraunhofer's class of diffraction, diffraction from single, double & N- Slits, theory of diffraction grating.

Recommended Book (s):

1. Introduction to Electrodynamics, D. J. Griffith
2. Physics for Scientists and Engineers with Modern Physics, J. W. Jewett and R. A. Serway
3. The Feynman Lecture on Physics 2 (2 nd Ed, 1985).
4. Electricity and Magnetism, Edward Mills Purcell

3. Mathematic I (MAT 103)

Review of high school calculus, Parametric curves (Vector functions): plotting, tangent, arc-length, polar coordinates, derivatives and integrals, Functions of several variables: level curves and surfaces,

differentiation of functions of several variables, gradient, unconstrained and constrained optimization, Double and triple integrals: integrated integrals, polar coordinates, cylindrical and spherical coordinates, change of variables. Vector fields, divergence and curl, Line and surface integrals, Fundamental Theorems of Green, Stokes and Gauss.

Recommended Book (s):

1. A Banner, The Calculus Lifesaver, Princeton University Press.
2. James Stewart, Essential Calculus – Early Transcendentals, Cengage.
3. G B Thomas and R L Finney, Calculus and Analytic Geometry, Addison- Wesley.
4. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley

4. Mathematic II (MAT 104)

First order ODEs: separable, exact, linear. Second order ODEs: homogeneous and nonhomogeneous linear, linear with constant coefficients, Wronskian, undetermined coefficients, variation of parameters. Laplace transform: definition and inverse, linearity, shift, derivatives, integrals, initial value problems, time shift, Dirac's delta function and partial fractions, convolution, differentiation and integration of transform. Matrices: operations, inverse, determinant, eigenvalues and eigenvectors, diagonalization. Systems of ODEs: superposition principle, Wronskian, constant coefficient systems, phase plane, critical points, stability

Recommended Book (s):

1. James Stewart, Essential Calculus – Early Transcendentals, Cengage.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley.

5. Introduction to Computing and Programming (CSD 101)

Introduction to Basic Fundamentals of Computers, Introduction to Programming, Identifiers and Constants, Data Types and Operators, Logical Expressions and Conditional Statements, Loops, Arrays, Functions, Scope of Variables, Pointers, Pointers and Arrays, Searching and Sorting in arrays, Strings, Recursion, Structures, Unions and Bit Manipulation, File Processing, Introduction to Data Structures.

Lab Plan - Introduction to Linux, Editor, GCC Compiler and Debugger. Introduction to basic Linux Commands, Programs based on Operators and Assignment Statements, Programs based on Control Statements, Programs based on Loop Statements, Array Programming, Function Programming, Programs based on Pointers, Call by Value and Call by Reference, Programs based on Recursion, Programs based on Strings, File Input Output.

Recommended Book (s):

1. C, How to Program, 7th Edition, Paul Deitel, Harvey Deitel, PHI Learning Pvt. Ltd. ISBN: 8120348273
2. Let Us C, 13th Edition, Yashavant Kanetkar, BPB Publications, ISBN: 978818333163

6. Engineering Mechanics (CED 101)

Introduction to Mechanics, Fundamental concepts of Mechanics, The Four Fundamental Forces of Nature, Force Vectors, Force Systems: Two-Dimensional and Three-Dimensional Force Systems, Vector Analysis of Force Systems, Rectangular Components, Moment, Couple, Force and Couple System,

Resultant of Force-Couple System, Simple Distributed Loading and its Reduction to Point Load, Equilibrium Conditions, System Isolation and Free-Body Diagram, Degree of Freedom, Constraints and Statical Determinacy, Supports and Connections, Determination of Support Reactions. Forms of Structures, Loads and Forces: Dead Load, Imposed Load and Forces, and Load Combinations, Idealization of Structures, Simple Trusses, Plane Truss, Space Truss, The Method of Joints, The Method of Sections, Frames and Machines, Arches and Cables, Internal Forces: Internal Loadings Developed in Structural Members, Shear and Moment Equations and Diagrams, Relations Between Distributed Load, Shear and Moment. Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. Work and Energy, Principle of Virtual Work, Principle of Virtual Work for a System of Connected Rigid Bodies, Conservative Forces, Potential Energy, Potential Energy Criterion for Equilibrium, Stability of Equilibrium Configuration. Introduction, Free Vibration: Undamped Free Vibration-Equation of Motion and its Solution, Damped Free Vibration- Equation of Motion and its Solution, Forced Vibration: Harmonic Excitation, Base Excitation, Undamped Force Vibration, Damped Force Vibration, Energy Methods.

Recommended Book (s):

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. J. L. Meriam and L.G. Kraige (2012), Engineering Mechanics, Vol I – Static, Vol II – Dynamics, 7th Edition, John Wiley & Sons, Inc.

7. Engineering Graphics (CED 102)

Introduction: Graphics as a tool to communicate ideas, Lettering and dimensioning, Types of Lines, First and Third angle projections. Projection of points. Pictorial view. Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems. Projection of planes in simple position. Principal and auxiliary planes, Construction of geometrical figures like pentagon and hexagon. Orthographic Projection: Principles of orthographic projections, Isometric Projection: Principles of isometric projection. Introduction to AutoCAD: 2D and 3D Modelling Introduction to SolidWorks. Introduction to 3D Printing. FDM hands-on. Lab work would include completing Drawing Assignments on Sheets, and in the later part of the semester, on AutoCAD.

Recommended Book (s):

1. Engg. Drawing by N D Bhatt
2. Engg. Drawing by Dhawan

8. Civil Engineering Systems and Sustainability (CED 104)

Introduction to Civil engineering systems, Structural Infrastructure systems: Foundations, Skyscrapers, Schools, Bridges, Dams, Levees, and Retaining Walls, Transportation Infrastructure

systems: Introduction to transportation systems, road, rail, airport, port and harbor, Environmental and Energy Infrastructure, Water Resources Infrastructure: dams, reservoirs, levees, and canals, Engineering Economics , Needs for planning, Infrastructure planning, Building materials: Clay products and alternatives like Fly-ash, Stone, stone tiles and stone dust blocks Wood and engineered wood, Glass and glazing systems, ceramic tiles, vitrified tiles, insulation, Fine aggregate, Coarse aggregate, Cement, Concrete, Precast items – flooring, roofing, walling system, Bitumen as damp proofing materials, Paints, Plastics, Composites, nanotechnology applications, natural materials, soil and rock, Sustainability, Role of civil engineer for sustainable development, Societal and Global Impact of Infrastructure, Introduction to sustainable development goals, Smart city concept, clean city concept, Safe city concept, Energy efficient buildings, recycling, Temperature and Sound control in buildings, Security systems; Smart buildings.

Recommended Book (s):

1. Building Materials by S K Duggal, New Age International Publisher
2. Introduction to Civil Engineering by S S Bhavikatti and A K Roopa, New Age International Publisher
3. Introduction to Civil Engineering: A Student's Guide to Academic and Professional Success by S. T Mau and Sami Maalouf, Cognella, Inc Publishers

9. Engineering Hydrology (CED 203)

Hydrologic cycle, Types of precipitation, Forms of precipitation, Measurement of Rainfall, Frequency analysis of point rainfall – Intensity, duration, frequency relationship, Probable maximum precipitation. Abstraction from Precipitation and Losses: Losses from precipitation, Evaporation process, Infiltration process, Infiltration capacity, Measurement of infiltration, Effective rainfall, W-Index and φ – Index. Stream Flow Measurement: Determination of stream flow using various methods-Direct determination, Indirect determination. Hydrographs: Runoff, Runoff characteristics, Discharge formulae, characteristics of a Run off hydrograph, Factors affecting Hydrograph, Base flow separation, Unit hydrograph, Derivation of unit hydrograph, S curve hydrograph, Unit hydrograph of different deviations, Synthetic Unit Hydrograph, Mass Flow hydrograph, Instantaneous hydrograph. Floods and Flood Routing: Flood peak estimation, Rational method, Empirical method, Unit hydrograph method, Flood frequency studies, Recurrence interval, Gumbel's method, Flood routing, Reservoir flood routing, Muskingum's Channel Routing, Flood control.

Recommended Book (s):

1. Subramanya, "Engineering Hydrology", Tata McGraw-Hill Education, 2008.
2. Ven Tee Chow, David Maidment, Larry Mays, "Applied Hydrology", 2nd Edition, McGraw-Hill Companies, Incorporated, 2013.
3. Deodhar M. J., "Elementary Engineering Hydrology", Pearson Education India, 2009.
4. Das, Ghanshyam, "Hydrology & Soil Conservation Engineering", PHI Learning Pvt. Ltd., 2009.
5. Ray K. Linsley, Max Adam Kohler, Joseph L. H. Paulhus, "Hydrology for engineers", Edition 3, illustrated, McGraw-Hill series in water resources and environmental engineering, McGraw-Hill, 1982.

10. Elements of Surveying (CED 206)

Overviews and Introduction (Basics of Surveying): Overview of elements of surveying; Brief ideas of technical terminologies and survey equipment; Fundamental concepts; Surveying measurements;

Mapping and conventional signs. Linear Measurement (Chain and Tape Surveying): Chain survey; Instruments (chains, tapes, ranging rods, etc.); Uses of cross staff and optical square; Offsets; Obstacles in chaining. Compass Surveying: Prismatic compass; Surveyor's compass; Bearing: whole circle (W.C.B) and reduced bearing (R.B); Local attraction and its adjustments; Traversing. Plane Table Surveying: Plane Table Instruments and Accessories; Merits and demerits; Methods; Orientation; Two and three point problems; Errors in plane tabling. Theodolite Surveying: Study of theodolite, Temporary and permanent adjustments; Measurement of horizontal and vertical angles; Overview on Optical and Electronic theodolites. Traverse Surveying: Traverse Surveying; Tacheometric surveying; Stadia method, Movable hair method; Trigonometric leveling and various methods. Levelling: Principle and definition; Levelling instruments; Dumpy level; Auto and Digital level; Booking and reducing levels; Curvature and refraction corrections; Bubble tube and its sensitiveness; Difficulties in Levelling. Contouring: Contour survey; Definition, Characteristics of contours; Methods of contouring; Interpolations; Uses of contour maps. Area and Volume Surveying: Areas and Volume computation; Trapezoidal rule; Simpson's rule; Other relevant methods for area and volume computation. EDM, and Minor instrumentation: Introduction to Electro-Magnetic Distance Measurement (EDM); EDM basic functions; Types of EDM instruments; Total Station Surveys. Minor Instruments: Box sexant; Planimeter; Pantagraph; Clinometer.

Recommended Book (s):

1. Punmia, B. C., "Surveying" Vol I and II, Laxmi Pub (1994).
2. Kanetkar T.P., "Surveying and Levelling", Vols. I and II, United Book Corporation, Pune (1994).
3. Duggal, S. K., "Surveying" Vol 1, Tata, McGraw Hill (2004).
4. S. K. Roy, Fundamentals of Surveying, PHI.

11. Hydraulics Engineering (CED 207)

Introduction: open channel flow and its classifications, and properties, types of channel, energy and momentum principles, Critical flow computation and its applications, transitions with sub critical and super critical flows,), Specific energy and specific energy curve, specific force, and pressure distribution in open channels. Applications of Bernoulli's equation to open channel flow. Uniform Flow: Chezy's formula, Manning's formula, Manning roughness coefficient, equivalent roughness, hydraulically efficient channel cross-section (most economical section), Velocity distribution in open channels, Normal Depth and its computation, flow in compound channel. Notches and Weir- Definitions, types of notches and weir, broad crested weir, sharp crested weir, triangular notch, rectangular notch, etc. Gradually varied flow – Theory and analysis, gradually-varied flow computations in prismatic channels, classification of flow profile, feature of flow profiles, back water curve and afflux. Rapidly varied flow- Theory of hydraulic jump and its application, evaluation of jump elements in rectangular and non-rectangular channel, location of jump on horizontal floor, channel controls and transitions.

Recommended Book (s):

1. Electrical Machinery P. S. Bhimbra, Khanna publishers, 2012.
2. Generalized Theory of Electrical Machines, P. S. Bhimbra. Khanna publishers, 1998.
3. Electrical Machinery, Fitzgerald and Kingsley, McGraw- Hill Higher education, 7th edition, 2013.
4. Electrical Machines, D. P. Kothari and I. J. Nagrath, McGraw- Hill Higher education, 4th edition, 2010.

5. John E. Gribbin, “Introduction to Hydraulics & Hydrology: With Applications for Stormwater Management”, Delmar Cengage Learning; 2 edition (September 11, 2001).
6. Hubert Chanson, “The Hydraulics of Open Channel Flow: An Introduction”, Butterworth Heinemann; 0002- edition (July 15, 2004)

12. Building Information Modelling (CED 214)

Current AEC (Architecture, engineering and construction) practices: The construction process, Role of Architects and Civil engineers, Structural designers, Site engineers, Construction management, costing and estimation, drawing-based design information, the impact of poor information on design, procurement, and construction management. Introduction to BIM: Master builder and information modelling, the digital revolution, the origin of BIM in computer aided design, BIM method or tool, Benefits and challenges in BIM, Various commercial Software packages, Case studies. BIM tools and parametric modelling: BIM an object oriented parametric modelling, beyond parametric shapes, Strength and limitations of object-based parametric modelling, Common data environment, BIM environment, platforms and tools. BIM for Architects and Engineers: Scope of design services, BIM in design process, building object models and libraries. Future prospective of BIM and case studies: The development of BIM up to today, current trends, Drivers of change and BIM impacts, case studies

Recommended Book (s):

1. Eastman, Charles M., et al. BIM handbook: A guide to building information modelling for owners, managers, designers, engineers and contractors. John Wiley & Sons, 2011.
2. Eynon, John. Construction manager’s BIM handbook. John Wiley & Sons, 2016.
3. Daniotti, Bruno, et al. BIM-Based Collaborative Building Process Management. Springer, 2020.
4. Garber, Richard. BIM design: realising the creative potential of building information modelling. John Wiley & Sons, 2014.
5. Crotty, Ray. The impact of building information modelling: transforming construction. Routledge, 2013.

13. Mechanics of Solid (CED 215)

Introduction to Mechanics of Deformable Bodies: A Short Review of Methods of Statics, Forces and Moments Transmitted by Slender Members: Differential Equilibrium Relationships, Singularity Functions and Three Dimensional Problems, Normal Stress and Strain, Shear Stress and Strain, Bearing Stress in Connections, Stress on an Oblique Plane under Axial Loading Conditions, Stress under General Loading Condition, Allowable Stresses and Allowable Loads, Design for Axial Loads and Direct Shear, Statically Determinate Structures, Statically Indeterminate Structures. Concept of Stress and Strain- Traction Vector, Stress Tensor, Plane Stress, Equilibrium of a Differential Element in Plane Stress, Stress Components Associated with Arbitrarily Oriented Faces in Plane Stress, Mohr’s Circle Representation of Plane Stress, Mohr’s Circle Representation of a General State of Stress, Analysis of Deformation, Definition of Strain Components, Relation Between Strain and Displacement in Plain Strain, Strain Components Associated with Arbitrary Sets of Axes, Mohr’s Circle Representation of Plane Strain, Mohr’s Circle Representation of General State of Strain, Measurement of Strains. Constitutive Relationships - The Tensile Test, Idealizations of Stress-Strain Curves, Elastic Stress-Strain Relations, Thermal Strain, Complete Equation of Elasticity, Strain Energy in an Elastic Body, Stress Concentration, Anisotropic Elasticity, Criteria for Initial Yielding, Behaviour Beyond Initial Yielding,

Introduction to Fracture and Fatigue, Plasticity and Creep. Torsion - Torsional Deformations of a Circular Bar, Circular Bars of Linearly Elastic Materials, Non- uniform Torsion, Stresses and Strains in Pure Shear, Transmission of Power by Circular Shafts, Statically Indeterminate Torsional Members, Strain Energy in Torsion and Pure Shear, Thin-Walled Tubes. Stress Due to Bending - Bending Deformations of a Symmetrical Beam, Pure Bending and Non uniform Bending, Curvature of a Beam, Longitudinal Strains in Beams, Normal Stresses in Beams (Linearly Elastic Materials), Design of Beams for Bending Stresses, Non prismatic Beams, Shear Stresses in Beams of Rectangular Cross Section, Shear Stresses in Beams of Circular Cross Section, Shear Stresses in the Webs of Beams with Flanges, Built-Up Beams and Shear Flow, Beams with Axial Loads, Stress Concentrations in Bending, Bending of Unsymmetrical Beams, The Shear-Center Concept. Deflections of Beams - Differential Equations of the Deflection Curve, Deflections by Integration of the Bending- Moment Equation, Deflections by Integration of the Shear-Force and Load Equations, Method of Superposition, Moment-Area Method, Nonprismatic Beams, Strain Energy in Bending, Castigliano's Theorem, Types of Statically Indeterminate Beams, Analysis by the Differential Equations of the Deflection Curve, Method of Superposition, Temperature Effects. Stability of Equilibrium: Buckling of Column - Buckling and Stability, Columns with Pinned Ends, Columns with Other Support Conditions Columns with Eccentric Axial Loads, The Secant Formula for Columns, Elastic and Inelastic Column Behaviour, Inelastic Buckling, Design Formulas for Columns.

Recommended Book (s):

1. Stephan H. Crandall and Norman C. Dahl, An Introduction to The Mechanics of Solids, McGraw Hill
2. F. P. Beer and E. R. Johnston, Mechanics of Materials, Tata McGraw Hill
3. James M. Gere and Barry J. Goodno, Mechanics of Materials, 7th Edition, Cenagage Learning.

14. Mechanics of Fluid (CED 216)

Fundamental Concepts of properties such as Mass density, weight density, specific gravity, specific volume, viscosity, compressibility and elasticity, surface tension, capillarity, vapor pressure, types of fluids, basic concepts applicable to fluid mechanics. Fluid statics: Pascal's law, hydrostatic law, pressure variation in fluids at rest. Absolute, atmospheric, gauge pressure, measurement of pressure using manometers. Total pressure and centre of pressure, total pressure on horizontal plane surface, vertical plane surface, Inclined plane surface, centre of pressure for vertical plane surface and for inclined plane surface, practical applications of total pressure and centre of pressure on dams, gates, and tanks. Fluid kinematics: Types of fluid flow, description of flow pattern, Lagrangian methods, Eulerian method, continuity equation, velocity and acceleration of fluid particles, velocity potential and stream function, streamline, streak line, path line, equipotential lines and flow net, uses of flow net, rotational and irrotational motions, circulation and vorticity . Fluid dynamics: Control volume and control surface, Forces acting on fluid in motion, NavierStokes Equation, Euler's Equation of motion, Integration of Euler's equations of motion, Bernoulli's Theorem and its derivation, Bernoulli's equation for compressible fluid and real fluid, Flow Measurement Devices: Practical applications of Bernoulli's Equation - Venturimeter, Orifice meter, nozzle meter, pitot tube, Flow through pipes: Loss of head through pipes, Darcy-Weisbach equation, minor and major losses. Hydraulic gradient line and energy gradient line, pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flow through branched pipes, three reservoir problem, siphon. Dimensional analysis and similitude: Dimensional homogeneity, Buckingham's π theorem, important dimensional numbers and their significance,

geometric, Kinematic and dynamic similarity, model studies. Boundary Layer Analysis: Development of boundary layer over flat surfaces. Boundary layer thickness.

Recommended Book (s):

1. Fluid Mechanics: Including Hydraulic Machines, by A. K. Jain; Khanna Publishers; 2008.
2. Hydraulics and Fluid Mechanics Including Hydraulics Machines, by P. N. Modi; Standard Book House; 2009. , ISBN: 8189401262, ISBN-13: 9788189401269.
3. Fluid Mechanics by R. K. Rajput; S. Chand; 2011, ISBN: 81-219-1666-6
4. Fluid Mechanics, by Frank White; Tata McGraw Hill Education Pvt. Ltd.; 2011.
5. Fluid Mechanics and Machinery by C.S.P.Ojha et.al, Oxford University Press, 2010, ISBN: 0-19-569963-7.
6. Fluid Mechanics by R. C. Hibbeler, Pearson Press, 2017, ISBN: 978-93-325-4701
7. Fluid Mechanics by Streeter, V.L. and Benjamin, W.E., McGraw-Hill.

15. Computational Methods (CED 217)

Introduction - Mathematical Modelling and Engineering Problem Solving, Approximations and round-off errors, Significant figures, Accuracy and precision, Errors, Round-Off errors, Error propagation and condition number of a problem, condition number of an algorithm, Truncation errors and the Taylor series. Solving Non-Linear Equations - Introduction, solving equation using an iterative method, The method of successive bisection, The method of false position, Newton-Raphson iterative method, The secant method, The method of successive approximations, Comparison of iterative methods, Solving polynomial equations, Solving simultaneous nonlinear equations. System of Linear Equations - Introduction, The Guass elimination method, Pivoting, Ill conditioned equations, Refinement of the solution obtained by Guass elimination, The Guass-Seidel iterative method, An algorithm to implement the Guass-Seidel method, Comparison of direct and iterative methods. Interpolation and Regression - Lagrange interpolation, Lagrange interpolation, Difference tables, Truncation error in interpolation, Spline interpolation, Linear regression, Algorithm for linear regression, Polynomial regression, Fitting exponential and trigonometric functions, Taylor series representation, Chebyshev series. Differentiation and Integration - Introduction, Numerical differentiation, Numerical integration, Simpson's rule, Truncation Error in integration formulae, Algorithms for integration of tabulated function, Algorithms for integrating a known function, Guassian quadrature formulae, Comparison of integration formulae. Numerical Solution of Differential Equations - Introduction, Euler's method, Taylor series method, Picard's method, Runge-Kutta methods, Runge-Kutta fourth order formula, Predictor-corrector method, Higher order differential equations, Comparison of predictor-corrector and Runge-Kutta methods.

Recommended Book (s):

1. Rajaraman (2018), Computer Oriented Numerical Methods, 4th Edition, Prentice Hall
2. Steven C. Chapra and Raymond P Canale (2015), Numerical Methods for Engineers, 7th Ed, McGraw Hill
3. Jaan Kiusalaas (2010), Numerical Methods in Engineering with Python, 2nd Ed, Cambridge University Press

16. Risk and Reliability Analysis (CED 218)

Introduction to reliability, Need for reliability evaluation, Measures of reliability, Sources of uncertainty, Steps in the modelling of uncertainty, Mathematics of probability, Axioms of probability,

Multiplication rule, Theorem of total probability, Bayes' theorem. Steps in quantifying randomness, Analytical models to quantify randomness, Multiple random variables, Commonly used probability distributions, Continuous random variables: Normal or Gaussian distribution, Log normal random variable, Beta distribution, Discrete random variables: Binomial distribution, Geometric distribution, Return period, Poisson distribution, Exponential distribution, Combination of continuous and discrete random variables: Hypergeometric and Hyperbinomial distribution, Extreme value distribution. Determination of probability distribution: Probability papers, Construction of probability paper, Statistical tests, Estimation of parameters of distribution: Method of moments, Method of maximum likelihood, Interval estimation of mean and variance: Interval estimation for the mean with known variance, Lower upper confidence limit for the mean with known variance, Interval estimation for the mean with unknown variance, Lower and upper confidence limit for the mean with unknown variance, Sample sizes in estimating the confidence interval of mean, Interval Estimation for the variance. Randomness in response variable -The known functional relationship between the response and a single basic random variable, Response as a known function of multiple random variables, partial and approximate solutions, Multiple random variables with unknown relationship, Regression analysis: Simple linear regression analysis, Coefficient of determination, Residual analysis, Multiple linear regression, Non-linear models. Fundamentals of reliability analysis Introduction, Deterministic and probabilistic approaches, Risk and safety factors concept, Risk-based design concept and the development of the risk-based design format: Load and resistance normal variables- single load case, Load and resistance normal variables-multiple load case, Load and resistance lognormal variables-single load case, Load and resistance lognormal variables-multiple load case, Fundamental concept of reliability analysis, First Order Reliability Methods (FORM): First-Order Second-Moment Method (FOSM) or MVFOSM Method, AFOSM Method for normal variables (Hasofer-Lind Method), AFOSM Methods for nonnormal variables, Risk-based design format using FORM.

Recommended Book (s):

1. Risk and Reliability Analysis, Vijay P. Singh, Sharad K. Jain, Aditya Tyagi, ASCE Press.
2. An Introduction to the Basics of Reliability and Risk Analysis, Enrico Zio, World Scientific.
3. Probability, Reliability and Statistical Methods in Engineering Design, Achintya Haldar, Sankaran Mahadevan, John Wiley & Sons, Inc.

17. Concrete Technology (CED 219)

Concrete Materials - Types of mate**rial, Cement :** cement production, composition, and properties; cement chemistry; Types of cements; special cements. Aggregates: mineralogy; properties, types of aggregates tests and standards. Brief idea about laboratory tests meant for cement and aggregate. Chemical and mineral admixtures: Admixtures - structure properties, and effects on concrete properties. Introduction to supplementary cementing materials and pozzolans. Fly ash, blast furnace slag, silica fume, and metakaolin - their production, properties and effects on concrete properties. Other mineral additives - reactive and inert, water reducers, air entrainers, set controllers. Concrete Mix Design -factors influencing mix proportion - Mix design by ACI method and I.S. code method - Design of high strength concrete. Properties of fresh and hardened concrete- Workability, Factors affecting workability, type of tests. Water cement ratio, gain of strength with age, effect of maximum size of aggregate, relationship between compressive and tensile, strength, high strength concrete, high performance concrete. Elasticity, shrinkage and creep of concrete. Durability of concrete - Introduction to durability; relation between durability and permeability. Chemical attack of concrete;

corrosion of steel rebars; other durability issues. Special concrete - Lightweight concrete. high density concrete, hot weather and cold weather concreting, polymer concrete.

Recommended Book (s):

1. Concrete Technology: M. L. Gambhir
2. Properties of concrete: A.M. Neville
3. Concrete Technology: M. S. Shetty

18. Structural Analysis (CED 220)

Introduction- Degree of indeterminacy and stability of structures; Drawing the influence lines using direct equilibrium; Influence lines for beams, girders and trusses. Analysis (displacement) of Statically Indeterminate Beams Energy methods, Theorem of Three moments, Two hinged arches (Reaction, horizontal thrust, Effect of yielding of supports, Temperature change). Analysis of Statically Indeterminate Structures Moment distribution method: Introduction, method development, solution of continuous beam, effect of settlement and rotation of support, frames with or without lateral sway. Slope deflection method: Introduction, development of slope deflection equations; Application to continuous beams and frames with and without lateral sway. Method of Consistent deformation (Force method): Continuous beams, Non-sway frames, Sway frames. Matrix Stiffness Method Introduction, member stiffness matrix; Transformation, compatibility and equilibrium, assemblage of structural stiffness matrix; Imposing support conditions; Banded property of structural stiffness matrix.

Recommended Book (s):

1. Kassimali, Structural analysis, Cengage Learning, Inc.
2. R. C. Hibbeler, Structural Analysis, Pearson Publications.
3. S. Reddy, Basic Structural Analysis, Tata McGraw Hill Publications

19. Transportation Engineering - I (CED 304)

Introduction: Breadth and scope of Transportation Engineering, modes of transportation and their comparison, effect of transportation systems on economy, impact on environment; Road transport Characteristics, Classification of roads, Road development plans in India, network patterns. Traffic Engineering: Traffic Studies, Origin-Destination studies, speed and delay studies, accident analysis, volume studies, passenger car equivalent, etc.; Traffic control Devices, marking, Signs, Signals, Regulations; Speed-flow- density relationship, Greenshields model, signal timing estimation, Capacity and Level-of- Service analysis. Roadway Geometry: Road, road user and vehicle characteristics, factors affecting design standards, cross-section elements, Stopping and overtaking sight distances, Road alignment, site selection, plan evaluation, Horizontal alignment, vertical alignment, design of summit and valley curves. Materials: Sub-grade soil, classification, group index, sub-grade soil stabilization; Aggregate, physical properties, mechanical properties, test on aggregates; Bituminous material, classification, tests on bitumen. Pavement Design: Necessity of pavement, types of pavements & characteristics, design parameters, wheel loads and axle loads, tyre pressure, load repetitions, ESWL; rigid and flexible pavement design, stresses in rigid pavement. Lab Work based on various testing methods for materials such as soil, aggregates, and bitumen as well as exercises based on traffic engineering concepts.

Recommended Book (s):

1. S. K. Khanna and C. E. G. Justo, "Highway Engineering",9th Edition, Nem Chand and Brothers (2011).
2. L.R. Kadiyali, "Traffic Engineering and Transport Planning",Khanna Publishers (2011).
3. Paul H. Wright and Karen K. Dixon, "Highway Engineering",7th Edition, Wiley India (2012).
4. Yang H. Huang, "Pavement Analysis and Design", Pearson Education India.
5. Ajay K. Duggal and Vijay P. Puri, "Laboratory Manual in Highway Engineering", New Age International.

20. Design of Reinforced Cement Concrete (RCC) Structures (CED 305)

Introduction to reinforced concrete, loads and load combinations, design philosophies. Flexural analysis and design of singly and doubly reinforced beams. Flexural analysis and design of flanged beams. Shear, diagonal tension and torsion in beams. Mid-term examination (as per University Examination Timetable). Bond, anchorage, development length, curtailments of reinforcement bars. Design of slabs, design of staircases. Design of columns. Design of footings. Limit states of serviceability. Final examination (as per University Examination Timetable).

Recommended Book (s):

1. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, 2013.
2. J. N. Bandyopadhyay, Design of Concrete Structures, Prentice Hall India, 2011.
3. H. Nilson, D. Darwin and C. W. Dolan, Design of Concrete Structures, Tata McGraw Hill, 2010.
4. E. G. Nawy, Reinforced Concrete - A Fundamental Approach, Prentice Hall, 2003.
5. M. L. Gambhir, Fundamentals of Reinforced Concrete Design, Prentice Hall India, 2006.
6. S. U. Pillai and D. Menon, Reinforced Concrete Design, Tata McGraw Hill, 2009.
7. P. C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall India, 2008.
8. K. Jain, Reinforced Concrete: Limit State Design, Nem Chand and Bros., 1999.
9. S. N. Sinha, Reinforced Concrete Design, Tata McGraw-Hill, 2nd Edition, 2002.
10. N. Krishna Raju, Design of Reinforced Concrete Structure (IS: 456-2000), CBS Publishers & Distributors, 2008.
11. R. Park and W. L. Gamble, Reinforced Concrete Slabs, John Wiley & Sons, 2002. XVII.

Indian Standard Codes of Practice:

1. IS 456: 2000 – Code of practice for plain and reinforced concrete, 2000.
2. IS 875: 1987 (Part 1 to Part 5) – Code of practice for design loads (other than earthquake) for buildings and structures, 1987.
3. SP 16: 1980 – Design Aids for Reinforced Concrete, 1980.
4. SP 24: 1983 – Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete, 1983.
5. SP 34: 1987 – Handbook of Concrete Reinforcement and Detailing, 1987.

21. Foundation Engineering and Design (CED 306)

Geotechnical investigation for determination of physical and engineering properties of subsurface soils. This will include planning and conducting field investigations and laboratory testing. Theory of lateral earth pressure; Methods of analyses; Bearing capacity theories; Design of shallow foundations: strip footings, isolated footings, combined footings, rafts; Design of deep foundations: single piles,

pile groups, pile caps, caissons, vertical uplift and lateral capacity; Design of retaining structures: rigid and flexible walls, coffer dams, diaphragm walls, braced cuts; Foundations in difficult grounds; Ground improvement techniques; Soil reinforcement. The lectures include an overview of geotechnical site investigation methods and in situ tests used to estimate engineering parameters. The course emphasizes the importance of parameter selection in calculations of ultimate and serviceability limit state calculations for both shallow and deep foundations, and discusses methods of soil improvement. The section on earth retaining structures considers systems ranging from gravity walls to composite construction (reinforced earth), from structural support to field monitoring of excavations (bracing, tieback anchors etc.).

Recommended Book (s):

1. J. E. Bowles, Foundation Analysis and Design, McGraw Hill, 1996.
2. Braja M. Das, Shallow Foundations: Bearing Capacity and Settlement, CRC Press, 1999.
3. Braja M. Das, Principles of Foundation Engineering, Cengage Learning India Pvt Ltd, 2013.
4. P. C. Varghese, Foundation Engineering, PHI Learning Pvt. Ltd., 2009.
5. V. N. S. Murthy, Advanced Foundation Engineering, CBS Publishers & Distibutors, 2010.
6. M. R. Hausmann, Engineering Principles of Ground Modification, McGraw Hill, 1990.
7. R. B. Peck, W. E. Hanson and T. H. Thornburn, Foundation Engineering, John Wiley & Sons, 1974.
8. K. Terzaghi, R. B. Peck and G. Mesri, Soil Mechanics in Engineering Practice, John Wiley & Sons, 1996.
9. K. R. Arora, Soil Mechanics and Foundation Engineering: Geotechnical Engineering, Standard Publishers Distributors, 1992.

22. Estimating, Costing and Project Management (CED 424)

Introduction to Construction Projects, stakeholders, phases in a project. Construction Economics. Client's Estimation of Project Cost. Construction Contract, Cost estimating and bidding- Contractor's perspective: material estimates, labour and equipment costs. Construction Planning, Project selection using time value of money concept, Project planning and network analysis-PERT, CPM, and Precedence Network. Resource scheduling, Time Cost trade off. Project Monitoring and Control system, Time -cost monitoring and control using S-curve and earned value analysis. Construction Claims, Disputes, and Project Closure. Introduction to use of project management software.

Recommended Book (s):

1. Bernard W. Taylor III. - Introduction to Management Science" (10 th edition, 2009), PEARSON - Prentice Hall.
2. Meredith, Wong, Woodhead and Wortman. "Design and Planning of Engineering Systems" (2 nd edn, Prentice Hall, 1985).
3. Kumar Neeraj Jha. "Construction Project Management", Pearson Education (2011).
4. K. K. Chitkara. "Construction Project Management : Planning, Scheduling and Controlling 2nd Edition", Tata McGraw - Hill Education.
5. Dutta, B.N "Estimation and Costing", UBS Publisher.
6. M. Chakraborti Rangwala S. C. "Elements of Estimating and Costing" Charotar Publishing Pvt Ltd. Anand. (1998).

23. Environmental Engineering (CED 308)

Introduction to water and waste water engineering: water and wastewater quality enhancement-philosophy of treatment, removal of turbidity and pathogens, IS standards for drinking water supply. Water and waste water quantity estimation: Water consumption rate, population forecasting methods for estimation of water demands. Water and wastewater characteristics: Sources of raw water, physical and chemical characteristics, Biological aspects, kinetic aspects of BOD, COD and other characteristics. Unit operations and processes of water treatment systems: Briefs of different operations and processes taking place during water treatment. Sedimentation: Discrete Particles, average settling velocity, designing circular settling basin, tube settlers or inclined plate settling. Coagulation and flocculation: colloidal stability, energy barrier-net attractive force, flocculation, design of flocculators. Softening and filtration: lime and soda ash requirement, Filtration, types of filters, filter washing, design of filters. Disinfection: Mechanism, Mechanism of Chlorine disinfection, Inhibition of respiratory enzymes. Introduction to domestic waste-water treatment: Waste-water management, schematic of waste-water treatment plant, primary, secondary and tertiary treatments, system of sanitation, sewage appurtenances, sewage and storm water pumping stations, quantity estimation of sewage and storm water, hydraulic design of sewers and storm water. Physical treatment processes: Flow equalization, aeration, screening, design of fine screens, grit, effect of grit, grit removal facility, skimming tank, water quality and estimation of organic content. Waste water treatment analysis: Introduction to microbiology, biological processes. Activated sludge process and lagoons. Attached growth aerobic process. Trickling filters and rotating biological contractors. Sequential batch reactor. Anaerobic treatment. Anaerobic process-UASB reactor. Membrane technology for waste-water treatment. Introduction to water and waste water engineering.

Recommended Book (s):

1. Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous “Environmental Engineering”, McGraw-Hill Book Co.,
2. Arcadio Sincero, and Pacquiao Sincero. “Environmental Engineering: A design approach”, PHI Learning Pvt Ltd.,
3. Metcalf and Eddy “Inc., Wastewater Engineering, Treatment and Reuse.” McGraw-Hill Higher Education.
4. Masters, Gilbert M., and Wendell Ela. “Introduction to Environmental Engineering and Science.” PHI Learning Pvt Ltd.,
5. Santosh Kumar Garg, “Water Supply Engineering” Khanna Publishers.
6. Santosh Kumar Garg, “Environmental Engineering: Sewage Disposal and Air Pollution Engineering” Khanna Publishers.
7. B. C. Punmia, Arun Kumar Jain, Ashok Kumar Jain “Water Supply Engineering”, Laxmi Publications.

24. Introduction to Remote Sensing and GIS (CED 310)

Introduction to Remote Sensing: Definition of Remote Sensing, History and scope of remote sensing, Electromagnetic Radiation (EMR) and atmospheric windows, Types of remote sensing. Thermal Emission of Radiation, Black body radiation, Radiation Principles: Plank’s Law, Stephen Boltezman law, Wien’s displacement law, Kirchoffs Law, Spectral signatures, Reflectance characteristics of Earths cover types. Satellite platforms, sensors and resolutions: Platforms: Airborne and Space borne, Sensors: Passive and Active, resolutions across track and along the track scanning, Optical sensors, Thermal scanners, and Microwave radar. Aerial Photography Satellite missions and image characteristics: Landsat series SPOT series, IRS satellite series, NOAA and MODIS series, etc. Image resolution: Spatial (IFOV), Spectral, Radiometric and Temporal, Image Preprocessing: radiometric, atmospheric

and geometric corrections. Application Studies: Applications of Remote sensing in Environmental monitoring and assessment, Applications of Remote sensing in Disaster Management, Land use/ Land Cover Analysis. Concepts on GIS: Definition, Basics of GIS and History, Geographic objects: point, line, area and their computer. Representation, Applications of GIS in various sectors. GIS Database (types, structures) and data Model, Geographic information and spatial data types (Map, Attributes, Image data). Data formats and Models: Raster data formats, vector data formats, advantages and disadvantages of raster and vector data formats. Data acquisition and analysis: Data acquisition (Inputs from RS imagery, GPS), Data entry & preparations (input, editing and attributing). Map scanning and digitizing, data conversion, linking of spatial and non-spatial data. Data manipulation and Spatial Data Analysis (Vector/Raster Geoprocessing)- Buffering, Viewshed Analysis, Raster/Vector Overlay Analysis, Map Algebra Introduction to GIS software and Case studies, Issues in spatial data quality, introduction to metadata and its importance. GIS Software, Introduction to Open Source GIS

Recommended Book (s):

1. Remote Sensing and Image Interpretation, 6th edition, T. Lillesand, R. Kiefer and J. Chipman, John Wiley.
2. Remote Sensing: Principles and Interpretation, 3rd edition, by: F. F. Sabins, W. H. Freeman & Co.; 1996, ISBN: 0-71- 672442-1.
3. Burrough, P.A. and McDonnell, R.A. (1998). Principles of Geographic Information System, Oxford University Press, Oxford.
4. Concepts and Techniques of Geographic Information Systems. (Author: YEUNG, ALBERT K. W., LO, C. P.) ISBN: 978-81- 203-3914- 9, Edition: 2nd Edition, PHI Learning, India.

25. Machine Learning for Civil Engineering (CED 323)

Introduction; Historical context; Need of ML in industry; ML in modern civil engineering; Real world applications in diverse fields; Data representation: Time series and Structured/Unstructured data; Forms of learning: Supervised, Unsupervised and Reinforcement learning; Understanding the terms: Artificial intelligence, Machine learning, Deep learning, Data mining, Analytics and Data science. Statistical learning Introduction; Bias and Variance; Cross-Validation; Mean square error; Data sampling; Precision-Recall Curves, F-score; Probability distributions; Normal distribution; Bayes theorem; Naive Bayes Classifier. Supervised learning- Introduction; Linear regression; Logistic regression; k-Nearest Neighbour (k-NN) classifier; Neural networks learning; Support vector machines (SVMs); Applications to structural damage detection, soil classification, etc. Convolutional Neural Networks- Introduction to convolutional neural networks; Neuron models; Activation functions; Single layer and Multilayer networks; Applications to camera-based classification and object detection related to structural health monitoring, vehicle detection, pavement distress detection, etc. Unsupervised clustering- Introduction; Clustering; Cluster analysis; Hierarchical clustering; K-means clustering; Density based clustering; Spectral clustering; Data transformation: Principal component analysis; Applications on transportation mode inference, level of service of roads, etc. Understanding machine learning by application- Using concepts of machine learning in small sized projects using tools such as Google Co Labs, MATLAB, Anaconda and Weka etc.

Recommended Book (s):

1. M. Gopal (2022), Applied Machine Learning, McGraw Hill Education (India) Private Limited, 2nd Edition.
2. James-A. Goulet (2020), Probabilistic Machine Learning for Civil Engineers, The MIT Press, Illustrated Edition.

3. O. Theobald (2017), Machine Learning For Absolute Beginners, Scatterplot Press, 2nd edition.
4. Andreas C. Müller, Sarah Guido (2016), Introduction to Machine Learning with Python, O'Reilly Media, Inc., First Edition.

26. Geotechnical Engineering (CED 325)

Origin and Classification of Soils – Soil Origin, Soil classification, Criteria for classifying soil, classification on the basis of grain size, classification on the basis of plasticity, Symbols and graphic representation, Classified soil and its engineering properties, Three phase system, Weight relationships, Volume relationships, Density and unit weight relationships, Inter-relationships. The Effective Stress Principle – Measurable stresses, Nature of effective stress, Distribution of effective stress with depth, Influence on effective stress of a shift in the water table. Permeability-soil type, void ratio, soil structure, effective stress, Darcy's law, Constant head permeameter, Falling head permeameter. Flow Analysis – One Dimensional Steady State Flow, Flow through Homogeneous deposit, Flow through layered systems, Effective stress under steady state one- dimensional flow, Seepage force, Downward flow, Upward flow, Quick condition, Two-dimensional steady state flow – Laplace equation, Flow nets, confined flow, unconfined flow, determining pore water pressures under two dimensional flow, Radial flow. Compressibility- effective stress, Normally consolidated and Over consolidated Clay. Terzaghi's One-dimensional Consolidation theory, Effective stress distribution in a compressible layer during consolidation, Consolidation and settlement, Determining coefficients of compressibility, and consolidation, Limitations in predicting consolidation behavior, Amount of consolidation, time of consolidation. Shear Strength of Soils – Measurement of shear strength, Mohr's circle, Types of Triaxial compression tests, Shear stress, shear strength and the Triaxial test, Stress-Strain behavior of sands, Stress-Strain behavior of clays, Concepts of failure, Stress conditions at failure in terms of total stresses, Stress conditions at failure in terms of effective stresses, Relationships among stresses at failure, Cohesion and Friction, Pore Water Pressure Parameters, Shear strength and strength parameters, Effective stress-strength parameters – a function of soil type, Effective stress-strength parameters – a function of stress history and stress range, Behavior of Overconsolidated Clays, Behavior of sands at high stresses, Effective stress analysis, Total stress analysis. Slope Stability Analysis – Stability of Infinite Slopes, Stability of finite slopes, Stability numbers, Method of slices, The Swedish method of slices, The critical failure surface, Non-circular failure surfaces, Two-wedge method.

Recommended Book (s):

1. Shashi K Gulhati, and Manoj Datta, Geotechnical Engineering, McGraw-Hill Companies
2. Braja M. Das (2010). Principles of Geotechnical Engineering (7th Edition), Cengage Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, PHI

27. Water Resources Engineering (CED 326)

Introduction: Necessity and Importance of Irrigation, types of Irrigation, Duty and delta, factors affecting duty, depth and frequency of Irrigation, irrigation efficiencies. Canals: Classification of canals, design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting, canal lining. Diversion Head works: Types of Diversion head works-diversion and storage head works, weirs and barrages, layout of diversion head works, components. Bligh's creep theory, Khosla's theory. Canal structures: types of falls and their location, design principles Cross Drainage works: types, selection of site, design principles of aqueduct, siphon aqueduct and super passage. Types of dams, merits and demerits, factors affecting selection of type of dam, factors governing selecting site for dam, types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, Spillways: types of spillways.

Recommended Book (s):

1. Irrigation and Water Power Engineering by Punmia, B. C., Lal, P. B. B, Jain, A. K., Jain, A. K., Laxmi Publications
2. Irrigation Engineering And Hydraulic Structures by Garg, S. K., Khanna Publishers
3. Irrigation, Water Power and Water Resources Engineering Arora, K. R, Standard Publisher Distributors
4. Elements of Water Resources Engineering by Duggal, K. N. and Soni, J. P., New Age International
5. Irrigation and Water Resources Engineering by Aswa, G. L., New Age International
6. Water Resources Engineering : Principles and Practice by Murthy, Satya N. Challa, New Age International
7. Irrigation Water Resources and Water Power Engineering by Modi, P. N, Standard Book House

28. Sustainable and Resilient Infrastructure (CED 327)

Introduction to Infrastructure Sustainability and Resilience, Sustainability impacts of infrastructure systems, Infrastructure design and operation principles, Infrastructure types and life cycle phases, Variables and processes in the infrastructure sustainability, Construction materials and methods, Infrastructure aging, Stakeholders and contributions, Consequences of climate change on infrastructure sustainability performance, Climate change impacts on the life cycle impacts and resiliency, Sustainability improvement and decarbonization of infrastructure sectors, Net-zero impact, reduction priorities, and compensation necessity, Carbon sinks and trade-offs between embodied and operational.

Recommended Book (s):

1. Sustainable Infrastructure for Cities and Societies by Michael Neuman, Routledge Taylor &Francis Group
2. Sustainable Building by Elisabeth Green, Tristram Hope, Alan Yates, ICE, Emerald Publishing Ltd.
3. Sustainable Infrastructure: Principle into Practice by Charles Ainger and Richard Fenner, ICE, Emerald Publishing Limited

29. Design of Steel Structure (CED 401)

Introduction: Properties of Structural Steel, I. S. Rolled Sections, I. S. Specifications. Design Approach: Factor of Safety, Permissible and Working Stresses, Elastic Method, Plastic Method, Introduction to Limit States of Design. Connections: Type of Connections, Riveted, Bolted and Welded Connections, Strength, Efficiency and Design of Joints, Modes of Failure of a Riveted Joint, Advantages and Disadvantages of Welded Joints, Design of Fillet and Butt Welds, Design of Eccentric Connections. Tension Members: Net Sectional Area, Permissible Stress, Design of Axially Loaded Tension Member, Design of Member Subjected to Axial Tension and Bending. Compression Members: Modes of Failure of a Column, Buckling Failure- Euler's Theory, Effective Length, Slenderness Ratio, Design Formula: I.S. Code Formula, Design of Compression Members, Design of Built-Up Compression Members: Laced and Battened Columns. Plastic analysis of structure: Basics of plastic analysis, Plastic hinge, Shape factor, Principles of plastic analysis, Mechanism and methods.

Beams: Design Procedure, Built-Up Sections, Plate Thickness, Web Crippling, Web Buckling, Connections and Curtailment of Flange Plates.

Recommended Book (s):

1. Limit state design in structural steel: M.R. Shiyekar.
2. Design of steel structure: N. Subramaniam.
3. Limit state design of steel structures: S.K. Duggal.

Opportunity for Undergraduate Research (OUR)

The Opportunities for Undergraduate Research (OUR) program at Shiv Nadar Institution of Eminence aims to give students hands-on experience in conducting research and doing independent work under faculty supervision. By participating in the OUR program, students are encouraged to satisfy their natural inquisitiveness and grow their expertise in research methodology. As a result, students have earned plaudits in the field of research from their early years in undergraduate studies.

The OUR program has been established to:

- Expand opportunities for an active form of learning by students
- Encourage the interaction of undergraduate students with faculty
- Expand the level of research activity on the campus
- Help identify and train potential candidates for our graduate programs
- Demonstrate that teaching and research are compatible and mutually reinforcing.

Students participating in the OUR program do not earn any credit for their degrees.

They should experience:

- A foundational understanding of how research is conducted in their disciplines
- A greater understanding of the information resources available and how to utilize these resources
- How to formulate research questions, and/or the fundamentals of experimental design
- How to interpret research outcomes.

First-year students (to be admitted in 2023-24) are not eligible for participation. A cumulative Grade Point Average of 6.5 is required to participate in this program. Fourth-year students' OUR projects should be distinct from their Bachelor's Thesis projects.

Individual research projects by UG students under the personal guidance of a faculty member is expected. A student can submit only one project. Consumables may be allowed against proper justification, but only up to a limit of INR 30,000 per project. All OUR project participants should present their results in an Undergraduate Research Conference to be held at SNIOE in August/Sept every year.

Some of the recent OUR projects from the department:

- Crop monitoring in the agricultural fields using satellite remote sensing techniques
- Modelling of crop yield using the AquaCrop model and data collected in agricultural fields
- A finite element modelling approach to determine the shape and pattern of recycled interlock pavement
- Study to understand the thermal performance of a non-air-conditioned hostel room of Shiv Nadar IoE
- Modelling of effective thermal properties of Phase Change Materials (PCM) – Cement mortar composites

Student Career

Recognizing the unique characteristics of each student and their diverse career aspirations, we tailor our assistance to meet individual needs. Whether students aim to enter the professional world, or pursue advanced studies, or embark on entrepreneurial ventures, our commitment to providing support remains steadfast.

Our objective is to empower students to effectively leverage their education and experiences to achieve their career objectives. Regardless of the career path they choose, whether it involves employment in an organization, further education, or entrepreneurship, our goal is to help students identify their strengths, aspirations, interests, and potential career opportunities. Through personalized guidance, we aim to equip students with the necessary tools and insights to enhance their readiness for careers and foster personal growth.

Industry Placement: We collaborate closely with our industry partners to grasp their project requirements, needs, and expectations for the campus recruitment process. Subsequently, we align qualified students with placement opportunities through both on-campus and off-campus hiring, internships, and projects.

Higher Studies: Students' ambitions for further studies are acknowledged and appreciated. Students are assisted by faculty members to enhance their profiles for advanced studies. We facilitate connections for students with our alumni who are currently pursuing higher education abroad, offering guidance on application procedures, providing information, and advising on admission requirements.

Entrepreneurship: Atal Incubation Centre (AIC) is actively engaged in cultivating entrepreneurship and aims to play a pivotal role in nurturing sustainable startups that contribute to increased employment opportunities and wealth creation. Numerous events and initiatives have been organized to raise awareness and encourage entrepreneurship and innovation.

Contact Us

For further details and clarifications, please write to one of the following:

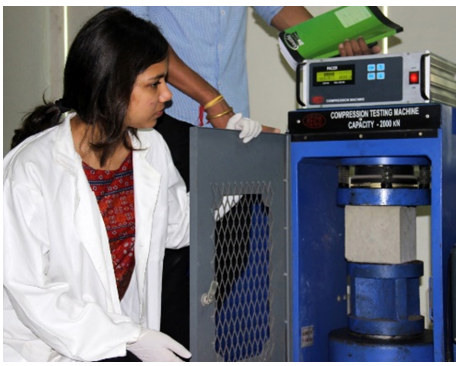
DR. GYAN VIKASH
Head,
Department of Civil Engineering
School of Engineering
Email: gyan.vikash@snu.edu.in
Telephone: 0120-7170209 (225)

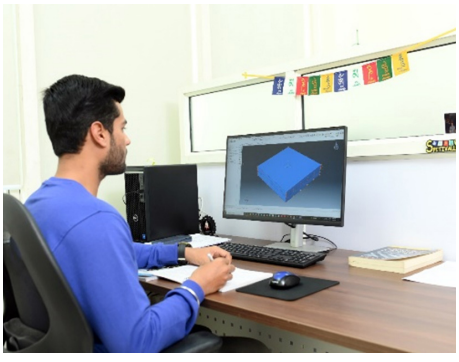
DR. GOPAL DAS SINGHAL
Associate Head,
Department of Civil Engineering
School of Engineering
Email: gopal.singhal@snu.edu.in
Telephone: 0120-7170209 (209)

DR. SHALINI RANKAVAT
UG Coordinator,
Department of Civil Engineering
School of Engineering
Email: shalini.rankavat@snu.edu.in
Telephone: 0120-7170209 (699)

MR. SACHDEV SINGH
Senior Executive Assistant
Department of Civil Engineering
School of Engineering
Email: sachdev.singh@snu.edu.in
Telephone: 0120-7170209 (209)

Glimpse of the University and Department Activities





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Scan Here For More Details:

CONTACT DETAILS

MR. SACHDEV SINGH
Senior Executive Assistant, Department of Civil Engineeringat sachdev.singh@snu.edu.in

DR. SHALINI RANKAVAT UG advisor
Department of Civil Engineering,
at shalini.rankavat@snu.edu.in

Head, Department of Civil Engineering,
at hod.civil@snu.edu.in

Shiv Nadar Institution of EminenceNH 91, Tehsil Dadri,
Gautam Buddha Nagar, Uttar Pradesh - 201314, India
Ph: +91-120-7170100, +91-120-2662002