AMRITA VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY
School of Pharmacy

Academic Regulations of B. Pharm Programme
(June 2023)

AMRITA VISHWA VIDYAPEETHAM | School of Pharmacy

VISION

To become a globally recognized academic and research-driven centre of excellence in pharmaceutical sciences through interdisciplinary collaboration that fosters innovation and excellence. We envision being a catalyst for positive change in healthcare, contributing to a sustainable future through holistic education, cutting-edge research, and community engagement.

MISSION

To provide high-quality academic programs and conduct impactful research for sustainable solutions to local and global challenges in pharmaceutical technology and practice. We aim to mold the students to become globally competent and compassionate pharmacy professionals and scientists with the knowledge, skills, and values necessary to excel in a rapidly evolving healthcare landscape.

PROGRAM LEARNING OBJECTIVES - B. PHARM

Knowledge:

1. Apply the fundamental pharmaceutical concepts and principles in the design, discovery, and development of drugs from natural and synthetic sources.
2. Demonstrate a comprehensive understanding of the structures and functions of various systems of the human body and biochemical changes in normal and disease states at cell and molecular levels.
3. Explain the methods of synthesis/isolation, characterization, and biological screening of synthetic and natural molecules.
4. Assess the physicochemical properties of drug substances and excipients to design, manufacture, and ensure the quality of dosage forms as recommended under current Good Manufacturing Practices (cGMP).
5. Illustrate the methods and strategies for drug delivery and optimize pharmaceutical formulations to enhance stability, safety, efficacy, and patient compliance.
6. Outline the laws, regulations, and guidelines governing preclinical and clinical research, stability assessment, manufacture, quality control, and sale of pharmaceuticals, herbal medicine, and nutraceuticals.
7. Illustrate the role of the pharmacist in drug procurement, prescription handling, patient counseling, and dispensing of medications.
8. Critically comment on the various programs of WHO and Govt. of India for the promotion of health and well-being.
9. Apply the principles of pharmacology and toxicology in the treatment of different diseases based on a comprehensive understanding of pharmacokinetics, and pharmacodynamics including dose, mechanism of action, adverse reactions, and drug interactions.

Skill

1. Demonstrate the techniques and equipment for synthesis, isolation manufacturing, and quality control of medicines in compliance with regulatory guidelines.
2. Acquire practical skills in the synthesis and analysis of drug substances, and predict suitable models and screening methods for their evaluation.
3. Apply pharmaceutical calculations in drug analysis, drug dosing, formulation development, and pharmacokinetics to optimize drug development, dispensing, and clinical practice.
4. Solve the real-world problems in drug development, manufacturing, dispensing and clinical use of medicines.
5. Operate different equipment according to the standard operating procedures.
6. Identify research problems, formulate hypotheses, and collect and analyze data.
7. Apply reasoning and principles of pharmacy practice to solve problems related to comprehending medical prescriptions, patient counseling, and drug safety.
8. Identify the risk factors associated with the development of disorders and interpret various physiological parameters relevant to human diseases.

Attitude

1. Appreciate creative thinking and apply innovative solutions to challenges.
2. Appreciate and upgrade technical, intellectual and emotional skills for lifelong learning.
3. Follow newer advancements and stay updated with the latest tools and techniques in pharmaceutical technology and healthcare practice.
4. Communicate effectively, collaborate, and work as a part of interdisciplinary healthcare teams and participate actively in discussions to solve complex problems.
5. Instill a patient-centered approach to improve the quality of life of patients, by prioritizing patients' needs, preferences, and values when providing pharmaceutical care.
6. Embrace a critical and analytical mindset to evaluate scientific literature, pharmaceutical research, and emerging trends in the field, fostering evidence-based decision-making.
7. Foster a proactive and inquisitive attitude towards continuous learning and professional development.
8. Develop a commitment to ethical practices and professional responsibilities in the pharmaceutical industry, including adherence to regulatory guidelines, patient safety, and confidentiality.
9. Assess societal, health, safety and legal issues and actively participate in civic activities to contribute to the common good.

B. PHARM REGULATIONS

1. Short Title and Commencement

These regulations shall be called Academic Regulations 2023 of Amrita Vishwa Vidyapeetham for the Bachelor of Pharmacy Program, which shall come into force from the academic session 2023-2024.

2. Minimum qualification for admission

2.1 B. Pharm (Regular):

Candidate shall have passed 10+2 examination with minimum 50% marks, conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities(AIU)with English as one of the courses and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B /P.C.M.B.) as optional courses individually or any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

2.2. B. Pharm lateral entry (directly to third semester):

A pass in D. Pharm program from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

The course of study for B. Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students.

4. Medium of instruction and examinations

The medium of instruction and examination shall be English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

100% attendance is necessary for the students, however, a candidate is required to have at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the requirements of the prescribed courses to be eligible to appear for the respective examination/s.

7. Program/Course credit structure

As per the philosophy of the Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, practice school, research project are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic/co-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course are dependent on the number of hours of instruction per week in that course and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical(laboratory) hours. Thus, for example, a theory course having weekly two lectures and one tutorial once in two weeks throughout the semester of 16 weeks carries a credit of 2.5. Similarly, practical having two laboratory hours per week throughout the semester carries a credit of 1.

7.2. Minimum credit requirements

The minimum credit points required for the award of a B. Pharm. degree is 170 out of which 151 are considered for CGPA calculation while for others there are only school-level examinations. These credits are divided into theory courses, tutorials, practical, practice school, and research project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table X. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall have successfully completed the D. Pharm program and have earned the minimum required credits from the same. Additionally, they shall gain 6 extra credit points for the following school level courses.

- Communication Skills (Theory and Practical) – 3 credits during their third semester
- Computer Applications in Pharmacy (Theory and Practical) – 3 credits during their fourth semester.

8. Academic work

A regular record of all academic activities for both Theory and Practical shall be maintained in Amrita University Management System (AUMS) by the faculty in charge of the respective courses.

9. Course of study

The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Tables – I to IX. The number of hours to be devoted to each theory, tutorial land practical course in any semester shall be as shown in Tables–I to IX.

Category: PHAR-Pharmacy courses; HUM-Humanities courses; SCI-Science courses; Skill-Skill based courses

Table-I: Course of Study for Semester I

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP101T	Human Anatomy and Physiology I–Theory	2	0.5	2.5
PHAR	BP102T	Pharmaceutical Analysis I–Theory	2	0.5	2.5
PHAR	BP103T	Pharmaceutics I– Theory	3	0	3
PHAR	BP104T	Pharmaceutical Inorganic Chemistry–Theory	2	0.5	2.5
HUM	BP105T	Communication skills–Theory*	2	-	2
SCI	BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics[#]–Theory*	2	-	2
HUM	22ADM101	Foundations of Indian Heritage - Theory*	2	0	2
HUM	22AVP103	Mastery Over Mind–Theory*	1	0	2
PHAR	BP109P	Pharmaceutical Analysis I–Practical	2	-	1
PHAR	BP110P	Pharmaceutics I–Practical	3	-	1.5
PHAR	BP111P	Pharmaceutical Inorganic Chemistry–Practical	2	-	1
HUM	BP112P	Communication skills–Practical*	2	-	1
		Total	**23/25[#]**	**1.5**	**20/22[#]**

[#]Applicable only for the students appearing for Remedial Biology (RB)/Remedial Mathematics (RM)course**.**

*School level exam (non CGPA)

Table II: Course of Study for Semester II

Category	Course Code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP201T	Human Anatomy and Physiology II–Theory	2	0.5	2.5
PHAR	BP202T	Pharmaceutical Organic Chemistry I–Theory	3	0	3
PHAR	BP203T	Biochemistry–Theory	2	0.5	2.5
PHAR	BP204T	Pharmaceutical Engineering–Theory	2	0.5	2.5
PHAR	BP205T	Computer Applications in Pharmacy–Theory*	2	-	2
HUM	22ADM111	Glimpses of Glorious India -Theory*	2	-	2
PHAR	BP207P	Human Anatomy and Physiology II–Practical	2	-	1
PHAR	BP208P	Pharmaceutical Organic Chemistry I–Practical	3	-	1.5
PHAR	BP209P	Biochemistry–Practical	2	-	1
PHAR	BP210P	Pharmaceutical Engineering–Practical	2	-	1
PHAR	BP211P	Computer Applications in Pharmacy–Practical*	2		1
		Total	**24**	**1.5**	**20**

***School level exam (non CGPA)**

Table III: Course of Study for Semester III

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP301T	Pharmaceutical Organic Chemistry II–Theory	2	0.5	2.5
PHAR	BP302T	Physical Pharmaceutics I–Theory	2	0.5	2.5
PHAR	BP303T	Pharmaceutical Microbiology–Theory	2	0.5	2.5
PHAR	BP304T	Pathophysiology–Theory	2	0.5	2.5
PHAR	BP305T	Pharmacognosy and Phytochemistry I–Theory	2	0.5	2.5
PHAR	BP306T	Social & Preventive Pharmacy–Theory	2	0.5	2.5
HUM	BP307T	Environmental sciences–Theory*	2	-	2
HUM		Amrita Value Programme I-Theory*	1	-	1
PHAR	BP309P	Pharmaceutical Organic Chemistry II–Practical	2	-	1
PHAR	BP310P	Physical Pharmaceutics I–Practical	2	-	1
PHAR	BP311P	Pharmaceutical Microbiology–Practical	2	-	1
PHAR	BP312P	Pharmacognosy and Phytochemistry I–Practical	2		1
		Total	**23**	**3**	**22**

***School-level exam (non-CGPA)**

Table IV: Course of Study for Semester IV

Category	Course code	Name of the course	No.of hours	Tutorial	Credit points
PHAR	BP401T	Pharmaceutical Organic Chemistry III–Theory	2	0.5	2.5
PHAR	BP402T	Medicinal Chemistry I–Theory	3	0.5	3.5
PHAR	BP403T	Physical Pharmaceutics II–Theory	2	0.5	2.5
PHAR	BP404T	Pharmacology I–Theory	3	0.5	3.5
PHAR	BP405T	Pharmacognosy and Phytochemistry II–Theory	2	0.5	2.5
PHAR	BP406T	Pharmaceutical Jurisprudence– Theory	2	0.5	2.5
HUM		Amrita Value Programme II–Theory*	1	-	1
PHAR	BP408P	Physical Pharmaceutics II–Practical	2	-	1
PHAR	BP409P	Pharmacognosy and Phytochemistry II– Practical	3		1.5
		Total	**20**	**3**	**20.5**

*School-level exam (non-CGPA)

Table V: Course of Study for Semester V

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP501T	Medicinal Chemistry II–Theory	2	0.5	2.5
PHAR	BP502T	Pharmaceutical Biotechnology–Theory	2	0.5	2.5
PHAR	BP503T	Pharmacology II–Theory	2	0.5	2.5
PHAR	BP504T	Herbal Drug Technology–Theory	2	0.5	2.5
PHAR	BP505T	Industrial Pharmacy I–Theory	2	0.5	2.5
PHAR	BP506T	Pharmacy Practice –Theory	2	0.5	2.5
HUM	BP507T	Life Skill I– Theory	2	0.5	2.5
PHAR	BP508P	Pharmacology II–Practical	2	-	1
PHAR	BP509P	Herbal Drug Technology–Practical	2	-	1
PHAR	BP510P	Industrial Pharmacy I–Practical	3	-	1.5
		Total	**21**	**3.5**	**21**

Table VI: Course of Study for Semester VI

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP601T	Medicinal Chemistry III– Theory	3	0.5	3.5
PHAR	BP602T	Pharmacology III–Theory	2	0.5	2.5
PHAR	BP603T	Biopharmaceutics and Pharmacokinetics– Theory	2	0.5	2.5
PHAR	BP604T	Industrial Pharmacy II–Theory	2	0.5	2.5
PHAR	BP605T	Quality Assurance–Theory	2	0.5	2.5
PHAR	BP606T	Pharmacotherapeutics– Theory	2	0.5	2.5
HUM	BP607T	Life Skill II–Theory	2	0.5	2.5
PHAR	BP608P	Medicinal chemistry III–Practical	2	-	1
PHAR	BP609P	Pharmacology III– Practical	2	-	1
		Total	**19**	**3.5**	**20.5**

Table VII: Course of Study for Semester VII

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP701T	Instrumental Methods of Analysis–Theory	3	0.5	3.5
PHAR	BP702T	Novel Drug Delivery System–Theory	2	0.5	2.5
PHAR	BP703T	Biostatistics and Research Methodology–Theory	2	0.5	2.5
PHAR	BP704ET	Pharma Marketing Management–Theory	2+2=4	0.5+0.5=1	2.5+2.5=5
PHAR	BP705ET	Pharmaceutical Regulatory Science–Theory			
PHAR	BP706ET	Cosmetic Science –Theory			
PHAR	BP707ET	Computer Aided Drug Design–Theory			
PHAR	BP708ET	Pharmacovigilance–Theory			
PHAR	BP709ET	Cell and Molecular Biology–Theory			
PHAR	BP710ET	Experimental Pharmacology–Theory			
PHAR	BP711ET	Quality Control and Standardization of Herbals Theory			
PHAR	BP712ET	Dietary Supplements and Nutraceuticals–Theory			
HUM	BP713T	Life Skill III–Theory	2	0.5	2.5
PHAR	BP714P	Instrumental Methods of Analysis–Practical	2	-	1
PHAR	BP715PW	Live in Labs #*	-	-	3
PHAR	BP716PS	Practice School	16	-	4
		Total	**31**	**3**	**21/24#***

***School level exams (non CGPA)

Out of the nine core electives from BP704ET to BP712ET; students need to opt for two courses

Live in Labs is an optional experiential learning initiative. Those who complete it successfully shall get a separate grade sheet/certificate.

Table VIII: Course of Study for Semester VIII

Category	Course code	Name of the course	No. of hours	Tutorial	Credit points
PHAR	BP801PR	Advanced Practice School & Research Project	32	-	16
	Total		**32**		**16**

Table IX: Value added and Skill based Electives

Cat.	Course code	Name of the course	No.of hours	Credit points	Semester in which course can be taken
HUM	BPHUM01	Language: Sanskrit*	2	2	1-IV
HUM	BPHUM02	Language: Hindi*	2	2	1-IV
HUM	BPHUM03	Language: Malayalam*	2	2	1-IV
HUM	BPHUM04	Psychology and Mental Health for Effective Living *	2	2	1-IV
HUM	BPHUM05	Gender equality*	2	2	1-IV
HUM	BPHUM06	Health & lifestyle*	2	2	1-IV
HUM	BPHUM07	Philosophy*	2	2	1-IV
HUM	BPHUM08	Economics*	2	2	1-IV
SCI	BPSCI01	Bioethics	2	2	III-VII
SCI	BPSCI02	Computer programming in AI	2	2	III-VII
SCI	BPSCI03	Medical/Scientific writing	2	2	III-VII
SCI	BPSCI04	Clinical data management	2	2	III-VII
SCI	BPSCI05	Medical coding	2	2	III-VII
SCI	BPSCI06	Pharmaceutical impurities	2	2	III-VII
SCI	BPSCI07	Nano synthesis	2	2	III-VII
SCI	BPSCI08	Medical Devices	2	2	III-VII
SCI	BPSCI09	Landmarks in drug discovery and major Indian contributions	2	2	III-VII
SKILL	BPSKILL01	Organizational behavior	2	1	III-VII
SKILL	BPSKILL02	Graphic design	2	1	III-VII
SKILL	BPSKILL03	Quality control of pharmaceuticals (SOP, Reporting)	2	1	III-VII
SKILL	BPSKILL04	Animal handling/ experiments	2	1	V-VII
SKILL	BPSKILL05	Statistical software	2	1	VII
SKILL	BPSKILL06	Quality by Design (QbD)	2	1	VII

*School-level exams only

Amrita Value Programmes I & II for UG programmes			
Course Code	Title	L-T-P	Credits
22ADM201	Strategic Lessons fromMahabharatha	1-0-0	1
22ADM211	Leadership from Ramayana	1-0-0	1
22AVP210	Kerala Mural Art and Painting	1-0-0	1
22AVP218	Yoga Therapy and Lessons	1-0-0	1
22AVP212	Introduction to Traditional IndianSystems of Medicine	1-0-0	1
22AVP201	Amma's Life and Message to themodern world	1-0-0	1
22AVP204	Lessons from the Upanishads	1-0-0	1
22AVP205	Message of the Bhagavad Gita	1-0-0	1
22AVP206	Life and Message of SwamiVivekananda	1-0-0	1
22AVP207	Life and Teachings of SpiritualMasters of India	1-0-0	1
22AVP208	Insights into Indian Arts andLiterature	1-0-0	1
22AVP213	Traditional Fine Arts of India	1-0-0	1
22AVP214	Principles of Worship in India	1-0-0	1
22AVP215	Temple Mural Arts in Kerala	1-0-0	1
22AVP218	Insights into Indian Classical Music	1-0-0	1
22AVP219	Insights into Traditional IndianPainting	1-0-0	1
22AVP220	Insights into Indian Classical Dance	1-0-0	1
22AVP221	Indian Martial Arts and SelfDefense	1-0-0	1
22AVP209	Yoga and Meditation	1-0-0	1

Value-added courses are those designed to enhance the capability of students beyond the general academic curriculum, which may help to improve the employability of the student. The program offers two categories of value-added courses – Humanities and Sciences. All value-added courses carry 2 credits each.

A student must opt for at least 1 language from the 3 languages offered – Malayalam, Sanskrit and Hindi and 1 other humanity course out of the remaining 5.

Under the Sciences category, there are 9 courses, and a student must opt at least 2 of them.

Skill-based courses are practical-oriented ones to provide the necessary skills to increase the employability quotient and equip the students with essential skills to succeed in life. The program offers 6 skill-based courses and each carries 1 credit. A student must opt for at least 1 course out of the 6 provided. Out of the above electives, the credits of science and skill-based electives are considered for the CGPA calculation and the grades of all electives completed will be included in the 8^{th}-semester grade sheet.

Table X: Semester wise credits distribution

	Credit Points		
Semester	**University**	**School level**	**Total**
I	**14**	**6/8[#]**	**20/22**
II	**15**	**5**	**20**
III	**19**	**3**	**22**
IV	**19.5**	**1**	**20.5**
V	**21**	**0**	**21**
VI	**20.5**	**0**	**20.5**
VII	**21**	**0/3***	**21/24**
VIII	**16**	**0**	**16**
Value added and skill based courses	**5**	**4**	**9**
Total credit points for the program	**151**	**19/21[#]/22[*]/24[#*]**	**170/172[#]/175[#*]**

[#]Applicable only for the students appearing for Remedial Biology (RB)/Remedial Mathematics(RM)course **(**non-CGPA**)**

[*]Applicable only for students opting live in labs.

10. Remedial Mathematics/Biology

There are two Remedial courses: Remedial Mathematics/Biology. Those who have not studied biology in plus two shall study Remedial biology and those who have not studied Mathematics in plus two shall study Remedial Mathematics in the first semester and those who have studied both Mathematics& Biology in Plus Two need not study any of these Remedial Courses.

11. Self-Directed Learning (SDL)

Self-directed learning is a process in which an individual takes initiative and responsibility for their own learning, actively engages in setting goals, acquiring knowledge, and evaluating the progress. It involves activities such as diagnosing learning needs, formulating learning goals, identifying resources, choosing and implementing learning strategies, and evaluating learning outcomes. Self-directed learning aims to empower learners to become independent and critical thinkers. Incorporating self-directed learning into daily classes or timetables can greatly enhance students' learning experiences and foster their autonomy.

Scope of SDL includes:

- SDL enables individuals to develop essential life skills, such as critical thinking, problem-solving, communication, and self-reflection.
- It empowers students to explore topics beyond the curriculum and pursue knowledge according to their own interests and pace thus becoming responsible learners.
- It allows for continuous professional growth, adapting to changing job requirements and exploring new career paths.
- It helps develop an entrepreneurial mindset, fosters creativity and innovation, and equips individuals with the necessary skills to start and manage their own ventures.
- Individuals can engage in self-directed learning to acquire new skills, deepen their knowledge in areas of personal interest, and even pursue hobbies that bring them joy and fulfillment.
- It encourages individuals to continue learning throughout their lives, embracing new challenges, and adapting to an ever-changing world.

Self-directed learning (SDL) is incorporated into the semester timetable as it is beneficial for students, promotes autonomy, motivation, and a deeper engagement with the learning process.

12. Academic Advisory Committee

The Academic advisory committee is constituted by the Head of the Institution for each batch of B. Pharm.

The composition of the Committee shall be as follows:

The Principal is the chairperson and senior faculty members of all departments (Associate Professor/Professor grade).

Terms of Reference:

i. Periodically reviewing the process of academic advising
ii. Discuss mentoring activities with students of each batch
iii. Interact with academic advising faculty and give suggestions for overall improvement
iv. Ensure proper documentation of these activities
v. The committee shall meet at least once in a semester

There is a provision for Academic Advising for each batch of B. Pharm. A group of 15 students is assigned under one faculty from the 1st semester onwards and the same faculty may continue till the completion of the 8th semester. The faculty shall interact with each student during the assigned period regarding academic/ other matters and the same shall be documented. Faculty provide guidance and support to their students offering advice, insights, and expertise based on their experiences. They help students to navigate challenges, set goals, and develop strategies for personal and professional growth. They can guide students in selecting electives, practice school, and research project considering their academic and personal interests to meet their ultimate goals.

13. Academic and Professional Standard Committee

The B. Pharm. program shall have an Academic and Professional Standard Committee constituted by the Head of the Institution and senior faculty members from each department involved in teaching B. Pharm courses.

The composition of the Committee shall be as follows:

Principal shall be the chairperson, HODs, and nominees from the departments of Assistant Professor/Associate Professor/Professor grade.

Terms of reference:

i. The committee shall meet once each semester, soon after the semester results are published.
ii. The committee calculates the attainment based on the results of both formative and summative assessments of each semester and reviews the same.
iii. Interact with faculty in case of courses with low attainment and recommend corrective measures for improvement.
iv. Auditing the question papers of both sessional exams and summative assessments and suggesting improvements wherever required.
v. Analyze the feedback collected from the students every semester.

14. Practice School

Practice school is an essential component of pharmacy education that offers students an opportunity to acquire practical skills in various settings such as hospitals, pharmacies, industries and research labs. The objective of practice school is to bridge the gap between theoretical knowledge and practical application in the real world. A comprehensive understanding of the definition, scope, and objectives of Practice School is given below.

Scope of Practice School:
The scope of Practice School is to provide students with a comprehensive learning experience that goes beyond classroom lectures. Students are exposed to real-world scenarios that challenge their problem-solving skills and enhance their ability to make decisions. The program provides students with an opportunity to interact with patients, healthcare professionals, and researchers, which helps them to develop their communication skills.
Practice School is an essential component of pharmacy education that provide students with a comprehensive learning experience that goes beyond classroom lectures. The program is designed to help students acquire practical skills, bridge the gap between theory and practice, expose them to real-world scenarios, enhance their communication skills, and evaluate their performance.

The objectives of Practice School are to:

- Develop practical skills: The program is designed to help students acquire practical skills that are essential in their chosen field of specialization.
- Bridging the gap between theory and practice: The program provides students with an opportunity to apply their theoretical knowledge in a practical setting.
- Exposure to real-world scenarios: The program exposes students to real-world scenarios that challenge their problem-solving skills and decision-making ability.
- Enhance communication skills: The program provides students with an opportunity to interact with patients, healthcare professionals, and researchers, which helps them to develop their communication skills.
- Working independently and as a team: Students get a feel of a real-life work environment and develop the ability to work independently and as a team.
- Identifying strengths and weaknesses: It also creates awareness among students about their strengths and weaknesses.

15. Practice School in the seventh semester

Practice School is a two-month program during the VII Semester in a hospital/community pharmacy to provide students with hands-on experience in pharmacy services. The program is designed to help students understand the daily operations of the pharmacy and develop skills in dispensing medication, counseling patients, and managing drug inventory.

16. Advanced Practice School and Research Project in the eighth semester

Advanced Practice School and Research Project is a four-month program conducted during the semester VIII of study that allows students to choose a specialization in the industry, hospital/ community pharmacy, or research department. The program is designed to give students an opportunity to apply their theoretical knowledge in a practical setting and gain hands-on experience in their chosen field of specialization. The students can opt for any two of the above three for a duration of two months each.
During the Advanced Practice School and Research Project, students are required to identify a real-life problem in their field of specialization and conduct a research project in any of the selected two options to find a solution to the problem. The research project is a mandatory component of the program, and students are expected to submit a report on their findings. The research project component of Practice School is designed to help students develop research skills, critical thinking, and problem-solving skills. It also helps students to apply the knowledge gained during the program to real-life situations and find practical solutions to problems in their field of specialization.

The Scope of the Research project:

The scope of a research project involves investigating a specific area of pharmacy, such as drug design and development, clinical pharmacy, pharmacology, pharmaceutical technology, sales and marketing. The goal of the research project is to advance knowledge in the field, address a specific research question or hypothesis, and contribute to the improvement of patient care. It is important for the research project to be feasible, ethical, and relevant to the current issues and challenges in pharmacy.

The objectives of the Research project are to:

Acquire research skills: Conducting a research project requires a range of research skills, such as literature review, data collection, data analysis, and interpretation of results. These skills are transferable and can be applied in various fields beyond pharmacy.

Develop scientific writing skills: The research project provides an opportunity to develop scientific writing skills, including how to write an introduction, methods, results and discussion sections of a research paper, as well as how to prepare a bibliography

Enable critical thinking ability: Research projects in pharmacy require critical thinking and analysis, which involve evaluating and interpreting data, drawing conclusions, and making evidence-based recommendations.

Adopt application-oriented learning: The research project provides an opportunity to apply the knowledge and skills learned in coursework to real-world scenarios. Students can investigate a current issue or challenge in pharmacy and propose practical solutions.

Appreciate time management and organizational skill: Conducting a research project requires planning, time management, and organization skills. Students learn how to prioritize tasks, set realistic goals, and manage their time effectively.

Enhance communication skills: Students can develop their communication skills by presenting their research findings to peers and faculty members, writing a research paper, and preparing a poster/ oral presentation.

Follow ethical considerations: Research projects in pharmacy require students to consider

ethical issues, such as confidentiality, informed consent, and the protection of human subjects. Students can learn about ethical guidelines and best practices in conducting research.
Overall, a research project in pharmacy provides an excellent opportunity for students to acquire a wide range of skills and competencies that are valuable for their future careers, whether in pharmacy services, academia, or research.

Evaluation and grading: The evaluation includes continuous assessment and final evaluation by the site preceptor and the school-level committee respectively. The final evaluation is done through a presentation mode, where students are required to present their practice school activities to the committee of experts in their field of specialization. In the case of Practice School of 7thsemester, a report shall be submitted by the student. A committee will evaluate the report based on the tasks accomplished during the practice school including prescription reading, prescription handling, patient counseling, drugs dispensed, their indications, category, dosing etc. In case of the Advanced Practice School and Research Project of 8th semester, a report in the form of a thesis shall be submitted. The committee will evaluate the report based on the relevance of the problem, the methodology used to find the solution, the effectiveness of the solution, the overall quality of the report etc. The total marks as well as the different criteria for the formative and summative assessment of Advanced Practice School and Research Project are given below.
The formative assessment of Practice School shall have 25 marks and that for Advanced Practice School & Research Project shall have 50 marks each and this shall be done by the site preceptor based on the following criteria.

Formative Assessment of Practice School:

Criteria	**Marks**
Regularity and enthusiasm	5 Marks
Skills acquired in day-to-day activities	10 Marks
Ability to learn and apply new concepts	10 Marks
Problem solving skills	-
Total	**25 Marks**

Formative Assessment of Advanced Practice School &Research Project:

Criteria	**Marks**
Regularity and enthusiasm	10 Marks
Skills acquired in day-to-day activities	20 Marks
Ability to learn and apply new concepts	10 Marks
Problem-solving skills	10 Marks
Total	**50 Marks**

The summative assessment of Practice School, Advanced Practice School & Research Project can be done on the following criteria:

Summative Assessment of Practice School:

Criteria	**Marks**
Objective(s) & Methodology	5 Marks
Outcomes	10 Marks
Presentation of work & Question and answer	10 Marks
Total	25 marks

Summative Assessment of Advanced Practice School & Research project:

Criteria	**Marks**
Objective(s) & Methodology	15 Marks
Results, Discussions & Conclusions/Outcomes	15 Marks
Presentation of work & Question and answer	20 Marks
Total	50 Marks

17. Condonation under exceptional cases:

If the attendance of a student falls short of 80% in any course, due to continuous absence caused by accident, prolonged illness, or unforeseen circumstances, such case may be considered by the Principal for condonation of absence based on the request of the student supported by the recommendation of the respective faculty advisor. However, in such cases, the student must have duly applied for leave in time. The overall attendance of a student in such a case shall not fall below 70%. Condonation will be considered only in the case of those students who have proved themselves to be otherwise regular, by attending at least 80% of the classes during the semester, excluding the period of long leave.

At least 70%physical presence is mandatory in every course even in such exceptional cases and this provision can be exercised by a student, only once in the program. However, the student may apply for a second condonation in the final year (8^{th} semester) provided he or she does not have any arrears.

Condonation cannot be claimed as a matter of right. It shall be granted at the discretion of the authorities, based on the genuineness and validity of the reasons cited for the absence. A student is not eligible for condonation if he had any unauthorized absence during the semester

18. Examinations/Assessments

The scheme for formative assessment and summative assessment is given in Table–XI.

18.1. Formative assessment

The formative assessment includes sessional exams, cycle tests, and assignments. There shall be two formative assessments (FA1 & FA2) and the marks of the cycle tests of FA1 and FA2 shall be submitted 10 days before the first and second sessional examination respectively. There shall be a minimum of two cycle tests per FA. The cycle test shall include questions of any type similar to that of end semester examination pattern. Students can be divided into groups of 5 or 6 students each and they shall submit an assignment on a specific topic which can be decided by the subject in charge at the beginning of the semester. The assignment topic shall be different for different groups. The average of FA1 and FA2 is to be considered as the formative assessment. In the case of practical courses included in CGPA calculation, 5 marks can be allotted to day-to-day assessment.

18.1.1. Sessional Exams

Two Sessional exams shall be conducted for theory and one sessional exam for practical courses as per the schedule fixed by the school. In case a student misses one sessional examination due to any medical emergency, he/she can attend a re-sessional examination covering the entire syllabus of the subject conducted before the summative assessments. The

scheme of question papers for theory and practical Sessional examinations is given below. The average marks of two formative assessments shall be computed for internal assessment as per the requirements given in tables -XI and XII.
For courses included in CGPA calculations, the sessional exam shall be conducted for 30 marks for theory and 35 marks for practical. The sessional exam shall be conducted for 20 marks for theory and 25 marks for practical in case of courses having school-level exams.

Question Paper pattern

Question paper pattern for theory Sessional examinations (as per blooms taxonomy)

For courses included in CGPA calculations:

I.	Multiple Choice Questions(MCQs) (Answer all the questions)	=	10x1=10marks
II.	Long Answers	=	1x10=10marks
III.	Short Answers	=	2x5 = 10marks
	Total	=	30marks

For courses having school level exams:

I.	Long Answers	=	1x10=10marks
II.	Short Answers	=	2x 5 = 10marks
	Total	=	20 marks

Question paper pattern for Practical Sessional examinations

For courses included in CGPA calculations:

I.	Synopsis	=	5marks
II.	Experiments	=	20 marks
III.	Viva voce	=	10marks
	Total	=	35 marks

For courses having school level practical exams:

I.	Synopsis	=	5 marks
II.	Experiments	=	15 marks
III.	Viva voce	=	5 marks
	Total	=	25 marks

18.2. Summative assessment

The summative assessment for each theory and practical course through semesters I to VII shall be conducted by the university except for the courses with the asterisk symbol (*) in table I -IX for which examinations shall be conducted by the subject experts at school level. The grades from school-level examinations are not included in CGPA calculation but the same shall be included separately in the grade sheets of the respective semesters. The grades of all value added and skill based elective courses received throughout the program shall be included in the eighth-semester grade sheet.

Tables-XI: Schemes for Formative assessment and Summative assessment semester wise

SemesterI

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2								
			Sessional		Cycle Test	Sessional		Cycle Test				Marks	Duration	
			Marks	Duration		Marks	Duration							
PHAR	BP101T	Human Anatomy and Physiology I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP102T	Pharmaceutical Analysis I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP103T	Pharmaceutics I– Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP104T	Pharmaceutical Inorganic Chemistry–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
HUM	BP105T	Communication skills–Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
SCI	BP106 RBT/RMT	Remedial Biology/ Remedial Mathematics[#]–Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
HUM	22ADM101	Foundations of Indian Heritage - Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
HUM	22AVP103	Mastery Over Mind–Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
Total			**200**	**10 hrs**	**40**	**200**	**10 hrs**	**40**	**40**	**20**	**300**	**300**	**12 hrs**	**600**

Category	Course code	Name of the course	Formative assessment		Attendance	Total Marks	Summative assessment		Total Marks
			Sessional	Day to Day assessment			Marks	Duration	
PHAR	BP109P	Pharmaceutical Analysis I–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP110P	Pharmaceutics I–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP111P	Pharmaceutical Inorganic Chemistry–Practical	35	10	5	50	50	4 hrs	100
HUM	BP112P	Communication skills–Practical*	25	-	-	-	25	3hrs	50
Total			**130**	**30**	**15**	**150**	**175**	**15 hrs**	**350**

Applicable ONLY for the students appearing for Remedial Biology(RB)/Remedial Mathematics(RM)course**.**

*School level exam (non CGPA)

Semester II

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2								
			Sessional		Cycle Test	Sessional		Cycle Test				Marks	Duration	
			Marks	Duration		Marks	Duration							
PHAR	BP201T	Human Anatomy and Physiology II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP202T	Pharmaceutical Organic Chemistry I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP203T	Biochemistry–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP204T	Pharmaceutical Engineering–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP205T	Computer Applications in Pharmacy–Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
HUM	22ADM111	Glimpses of Glorious India - Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
Total			**160**	**8 hrs**	**40**	**160**	**8 hrs**	**40**	**30**	**20**	**250**	**250**	**10 hrs**	**500**

Category	Course code	Name of the course	Formative assessment		Attendance	Total Marks	Summative assessment		Total Marks
			Sessional	Day to Day assessment			Marks	Duration	
PHAR	BP207P	Human Anatomy and Physiology II–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP208P	Pharmaceutical Organic Chemistry I–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP209P	Biochemistry–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP210P	Pharmaceutical Engineering–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP211P	Computer Applications in Pharmacy-Practical*	25	-	-	-	25	3hrs	50
Total			**165**	**40**	**20**	**200**	**225**	**19 hrs**	**450**

*School level exam (non CGPA)

Semester III

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2								
			Sessional		Cycle Test	Sessional		Cycle Test						
			Marks	Duration		Marks	Duration					Marks	Duratio	
PHAR	BP301T	Pharmaceutical Organic Chemistry II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP302T	Physical Pharmaceutics I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP303T	Pharmaceutical Microbiology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP304T	Pathophysiology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP305T	Pharmacognosy and Phytochemistry I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP306T	Social & Preventive Pharmacy-Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
HUM	BP307T	Environmental sciences–Theory*	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
HUM		Amrita Vaulue Programme I	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
Total			**220**	**11 hrs**	**60**	**220**	**11 hrs**	**60**	**40**	**30**	**350**	**350**	**14 hrs**	**700**

*School level exam (non CGPA)

Category	Course code	Name of the course	Formative assessment				Summative assessment		Total Marks
			Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
PHAR	BP309P	Pharmaceutical Organic Chemistry II–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP310P	Physical Pharmaceutics I–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP311P	Pharmaceutical Microbiology–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP312P	Pharmacognosy and Phytochemistry I–Practical	35	10	5	50	50	4 hrs	100
Total			**140**	**40**	**20**	**200**	**200**	**16 hrs**	**400**

Semester IV

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2								
			Sessional		Cycle Test	Sessional		Cycle Test				Marks	Duration	
			Marks	Duration		Marks	Duration							
PHAR	BP401T	Pharmaceutical Organic Chemistry III–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP402T	Medicinal Chemistry I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP403T	Physical Pharmaceutics II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP404T	Pharmacology I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP405T	Pharmacognosy and Phytochemistry II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP406T	Pharmaceutical Jurisprudence–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
HUM		Amrita Value Programme II	20	1hr	-	20	1 hr	-	5	-	25	25	1 hr	50
Total			**200**	**10 hrs**	**60**	**200**	**10 hrs**	**60**	**35**	**30**	**325**	**325**	**13 hrs**	**650**

*School level exam (non CGPA)

Category	Course code	Name of the course	Formative assessment				Summative assessment		Total Marks
			Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
PHAR	BP408P	Physical Pharmaceutics II–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP409P	Pharmacognosy and Phytochemistry II–Practical	35	10	5	50	50	4 hrs	100
Total			**70**	**20**	**10**	**100**	**100**	**8hrs**	**200**

Semester V

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2						Marks	Duration	
			Sessional		Cycle Test	Sessional		Cycle Test						
			Marks	Duration		Marks	Duration							
PHAR	BP501T	Medicinal Chemistry II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP502T	Pharmaceutical Biotechnology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP503T	Pharmacology II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP504T	Herbal Drug Technology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP505T	Industrial Pharmacy I–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP506T	Pharmacy Practice- Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
HUM	BP507T	Life Skill I– Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
Total			**210**	**10.5**	**70**	**210**	**10.5**	**70**	**35**	**35**	**350**	**350**	**14**	**700**

Category	Course code	Name of the course	Formative assessment				Summative assessment		Total Marks
			Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
PHAR	BP508P	Pharmacology II–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP509P	Herbal Drug Technology–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP510P	Industrial Pharmacy I–Practical	35	10	5	50	50	4 hrs	100
Total			**105**	**30**	**15**	**150**	**150**	**12 hrs**	**300**

Semester VI

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2						Marks	Duration	
			Sessional		Cycle Test	Sessional		Cycle Test						
			Marks	Duration		Marks	Duration							
PHAR	BP601T	Medicinal Chemistry III–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP602T	Pharmacology III–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP603T	Biopharmaceutics and Pharmacokinetics–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP604T	Industrial Pharmacy II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP605T	Quality Assurance–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP606T	Pharmacotherapeutics– Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
HUM	BP607T	Life Skill II–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
Total			**210**	**10.5**	**70**	**210**	**10.5**	**70**	**35**	**35**	**350**	**350**	**14**	**700**

Category	Course code	Name of the course	Formative assessment				Summative assessment		Total Marks
			Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
PHAR	BP608P	Medicinal chemistry III–Practical	35	10	5	50	50	4 hrs	100
PHAR	BP609P	Pharmacology III– Practical	35	10	5	50	50	4 hrs	100
Total			**70**	**20**	**10**	**100**	**100**	**8hrs**	**200**

Semester VII

Category	Course code	Name of the course	Formative assessment						Assignment	Attendance	Total Marks	Summative assessment		Total Marks
			FA1			FA2								
			Sessional		Cycle Test	Sessional		Cycle Test				Marks	Duration	
			Marks	Duration		Marks	Duration							
PHAR	BP701T	Instrumental Methods of Analysis–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP702T	Novel Drug Delivery System–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP703T	Biostatistics and Research Methodology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP704ET	Pharma Marketing Management–Theory												
PHAR	BP705ET	Pharmaceutical Regulatory Science–Theory												
PHAR	BP706ET	Cosmetic Science –Theory												
PHAR	BP707ET	Computer Aided Drug Design–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP708ET	Pharmacovigilance–Theory	+	+	+	+	+	+	+	+	+	+	+	+
PHAR	BP709ET	Cell and Molecular Biology–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
PHAR	BP710ET	Experimental Pharmacology–Theory												
PHAR	BP711ET	Quality Control and Standardization of Herbals Theory												
PHAR	BP712ET	Dietary Supplements and Nutraceuticals–Theory												
HUM	BP713T	Life Skill III–Theory	30	1.5 hrs	10	30	1.5hrs	10	5	5	50	50	2 hrs	100
Total			**180**	**9 hrs**	**60**	**180**	**9 hrs**	**60**	**30**	**30**	**300**	**300**	**12 hrs**	**600**

*****The subject experts at the school level shall conduct examinations

Category	Course code	Name of the course	Formative assessment				Summative assessment		Total Marks
			Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
PHAR	BP714P	Instrumental Methods of Analysis-Practical	35	10	5	50	50	4 hrs	100
Total			**35**	**10**	**5**	**50**	**50**	**4 hrs**	**100**

Cat.	Course code	Name of the course	Formative Assessment	Summative Assessment	Total Marks
PHAR	BP716PS	Practice School	25	25	50

Semester VIII

Cat.	Course code	Name of the course	Formative Assessment	Summative Assessment	Total Marks
PHAR	BP801PR	Advanced Practice School& Research Project	50	50	100

Table XII:-Value added and Skill based Electives

Name of the course	Formative Assessment						Assignment	Attendance	Total Marks	Summative Assessment		Total Marks
	FA1			FA2								
	Sessional		Cycle Test	Sessional		Cycle Test				Marks	Duration	
	Marks	Duration		Marks	Duration							
Value added CGPA courses (Theory)	30	1.5hrs	10	30	2hrs	10	5	5	50	50	2hrs	100
Value added non CGPA courses (Theory)	20	1hr	-	20	1hr	-	5	-	25	25	1 hr	50

Name of the course	Formative Assessment				Summative Assessment		Total Marks
	Sessional	Day to Day assessment	Attendance	Total Marks	Marks	Duration	
Skill development CGPA courses (Practical)	35	10	5	50	50	4 hrs	100

Table-XIII: Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95– 100	5	5
90– 94	4	4
85– 89	3	3
80– 84	2	2
Less than 80	0	0

19. Promotion and award of grades

A student shall be declared a Pass and eligible for getting a grade in a course of B. Pharm program if he/she secured an aggregate of 50% with a minimum of 40% marks each in formative and summative assessments. For example, to be declared as PASS and to get a grade, the student has to secure a minimum of 20 marks in the formative assessment and 20 marks in the summative assessment of theory examinations and a minimum of 20 marks each in the formative and summative assessment of practical examinations.

20. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 18, then he/she shall reappear for the next university examination of that course. However, his/her marks of the formative Assessment shall be carried over and he/she shall be entitled for the grade obtained by him/her on passing the summative assessment examination.

21. Supplementary examination of summative assessment

Supplementary examinations of summative assessment shall be conducted as per the schedule given in table XIV. The exact dates of examinations shall be notified from time to time.

Table-XIV: Tentative schedule of summative assessments

Semester	for Regular Candidates	for Failed Candidates
I, III,V and VII	November/December	May/June
II, IV,VI and VIII	May/June	November/December

Question paper pattern for summative theory examinations (as per blooms taxonomy)

For courses included in CGPA calculations:

I. Multiple Choice Questions (MCQs)(Answer all the questions)		=	20x1=20marks
II.	Long Answers		1x10=10marks
III.	Short Answers	=	4x5=20marks
		=	----------
	Total	=	50marks

For courses having school level exams:

I.	Long Answers		1x10=10marks
II.	Short Answers	=	5x3=15marks
		=	----------
	Total	=	25marks

Question paper pattern for summative assessment of practical examinations

I.Synopsis		=	10marks
II.Experiments		=	25 marks
III.Viva voce		=	15marks
		-	----------
	Total	=	50marks

Question paper pattern for courses having school level exams:

I.	Synopsis	=	5 marks
II.	Experiments	=	15 marks
III.	Viva voce	=	5 marks

	Total	=	25Marks

22. Eligibility of Examiners & Question Paper Setters

Faculty of Amrita School of Pharmacy who are handling the respective courses with a minimum of 2 years of experience / Ph.D shall be appointed as examiners/Question paper setters for semester I to semester IV B. Pharm examination and teachers with a minimum of 3 years' experience / Ph.D shall be appointed as examiners/Question paper setters for the remaining semesters.

External faculty members of reputed universities with relevant teaching experience shall be appointed by the Addl.Controller of Examinations as observers. During the end semester practical examinations, such observers shall be appointed for selected courses randomly in every semester who shall oversee the conduct of the practical examination, verify the practical records, theory QP etc., and submit a report in the prescribed format to the Addl. Controller of Examinations. Faculty with a minimum of 5 years of teaching experience in the concerned subject of B.Pharm shall be appointed as observers. One external faculty shall serve as an observer for exams of 2 or 3 courses of B.Pharm if scheduled on the same day or adjacent days.

23. Academic Progression

No student shall be admitted to any examination unless he/she fulfills the norms specified in 6.

Academic progression rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of the I and II semesters are successfully completed.

Similarly, a student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of the VII semester until all the courses of the I, II, III, and IV semesters are successfully completed.

A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 29.

A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.

A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed.

A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 29.

Note: Grade I as well as those students who fail to register for examination(s) of any course in any semester will be treated as grade F for deciding academic progression.

24. Grading of performances

24.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a 10 point relative letter grading at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table– XV.

Table – XV: Letter grades and grade points

Letter Grade	Grade Point	Performance
A+	10	Excellent
A	9	Very Good
B	8	Good
C	7	Fair
D	6	Average
E	5	Pass
F	0	Fail
I	0	Incomplete

A learner who remains absent for the summative assessment shall be assigned a letter grade of I and a corresponding grade point of zero. He/she should reappear for the said examination/evaluation in due course.

24.2. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester withcreditsC1, C2, C3, C4and C5and the student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C_1G_1+C_2G_2+C_3G_3+C_4G_4+C_5G_5}{C_1+C_2+C_3+C_4+C_5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and AB grade awarded in that semester. For example, if a learner has a F or I grade in course 4, the SGPA shall then be computed as:

$$SGPA = \frac{C_1G_1+C_2G_2+C_3G_3+C_4*ZERO+C_5G_5}{C_1+C_2+C_3+C_4+C_5}$$

24.3. Cumulative Grade Point Average. (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s)is/are passed. When the course(s)is/are passed by obtaining pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1+C_2S_2+C_3S_3+C_4S_4+C_5S_5+C_6S_6+C_7S_7+C_8S_8}{C_1+C_2+C_3+C_4+C_5+C_6+C_7+C_8}$$

where $C_1, C_2, C_3,\ldots$ is the total number of credits for semester I,II,III,…. and $S_1, S_2, S_3,\ldots$ is the SGPA of semester I,II,III,…..

25. Declaration of class

The class shall be awarded based on CGPA as follows:

First Class with Distinction	= CGPA of. 7.50 and above
First Class	=CGPA of 6.00to7.49
Second Class	=CGPA of 5.00 to 5.99

26. Improvement of Internal marks

A student who fails in university examination in the first attempt can apply for improvement sessional exam by submitting the duly filled application form when notified by the Principal.

27. Revaluation

A failed student shall have the right to apply for revaluation of the theory paper by filling the application form along with the required fees within the stipulated time after the publication of the result.

28. Award of Ranks

Ranks and Medals shall be awarded based on the final CGPA. However, candidates who fail in one or more courses during the B. Pharm program shall not be eligible for the award of ranks. Moreover, the candidates should have completed the B. Pharm program in a minimum prescribed number of years, (four years/ three years for B. Pharm Lateral entry) for the award of Ranks.

29. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

30. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration (eight academic years) of the program and the students have to pass within the said period, otherwise they have to get fresh Registration. There shall not be any supplementary batch for any semester.

31. Re-admission after break of study

A candidate who seeks readmission to the program after a break of study has to get approval from the principal by making a written request. Readmission will not be permitted for the candidate who has more than 2 years of breakup period.

Note:

Point No 22 which describes the eligibility of the examiners and question paper setters shall be applicable to all the current batches of B. Pharm w.e.f AY 2023-24 and as per it, faculty of Amrita School of Pharmacy who are handling the respective courses with a minimum of 2 years of experience / Ph.D shall be appointed as examiners/Question paper setters for semester I to semester IV B. Pharm examination and teachers with a minimum of 3 years' experience / Ph.D shall be appointed as examiners/Question paper setters for the remaining semesters.

SEMESTER-I

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Human Anatomy and Physiology I **(T)**	**2**	**0.5**	**0**	**30**	**2.5**	**I**	**BP101T**

SCOPE:

The course primary goal is to learn how the different bodily systems work together to maintain homeostasis. By understanding the interconnected mechanisms involved in homeostasis, students can appreciate how various processes are controlled and balanced within the body. It provides the foundation necessary to comprehend pathophysiology and pharmacology. It helps students to develop the skills to determine various body parameters that provide insights into an individual's health status.

These skills are important for healthcare professionals to diagnose, monitor, and treat patients effectively. Furthermore, a solid understanding of this subject empowers individuals to support the healthcare system and educate the general public about various aspects of health.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1 : State the anatomical and physiological terms associated with the human body
K2 : Describe the physiological process involved in the homeostasis of the human body
K3 : Appreciate the interlinked mechanisms involved in the homeostasis of the human body
K4 : Summarize the disorders that affect various organs of the human body
K5 : Differentiate the histology of tissues and organs of the human body
K6 : Demonstrate the coordinated working pattern of different organs of each system

SKILL

S1 : Distinguish the various tissues and organs of the human body
S2 : Compute cardiac output based on given haemodynamic values
S3 :Assess potential risks and complications associated with mismatched blood transfusions.
S4 : Interpret the laboratory values of humans associated with various diseases states related to blood, CVS, bone and Urinary system
S5 : Apply knowledge of skeletal anatomy and biomechanics to enhance performance in sports and physical activities.
S6 : Predict common skeletal injuries, such as fractures, dislocations, and sprains.

ATTITUDE

A1 : Appreciate the knowledge of Anatomy and Physiology for studying pathophysiology and pharmacology

A2 : Demonstrate interest, enthusiasm, and willingness to learn as seen through active participation.
A3 : Support other healthcare professionals/fellow people in educating the society.
A4 : Exhibit professionalism in the working environment.
A5 : Participate in healthcare initiatives by the government.
A6 : Embrace the newer advancements in the healthcare

COURSE CONTENTS

UNIT I **6 Hours**

Introduction

Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, and basic anatomical terminology. (1 hr)

Cellular level of organization (2 hrs)

Biological importance of a cell and organelles,

General principles of cell communication, intracellular signalling pathway activation by extracellular signal molecule,

Forms of intracellular signalling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization (3 hrs)

Classification of tissues, structure, location, and functions of epithelial, muscular, nervous, and connective tissues.

UNIT II **6 Hours**

Integumentary System

Integumentary system - Structure and functions of skin, (2 hrs)

Skeletal system (3 hrs)

Divisions of the skeletal system, types of bone, salient features, and functions of bones of the axial and appendicular skeletal system

Organization of skeletal muscle, physiology of muscle contraction,

Joints (2 hrs)

Structural and functional classification, types of joints movements, and their articulation

UNIT III **8 Hours**

Circulatory System

Body fluids (3 hrs)

Body fluids, composition, and blood functions, hemopoiesis, haemoglobin formation, coagulation mechanisms,

Blood grouping, Rh factors, transfusion, and its significance. Reticuloendothelial system. (2 hrs)

Lymphatic system (3 hrs)

Lymphatic organs and tissues with special reference to spleen, thymus, lymph node & payer's patches, lymphatic vessels, lymph circulation, and functions of the lymphatic system

UNIT IV **6 Hours**

Cardiovascular System

Heart – anatomy of heart, blood circulation, blood vessels. (2 hrs)

elements of the conduction system of the heart (1 hr)

Cardiac output, cardiac cycle. (2 hrs)

Regulation of blood pressure, pulse, electrocardiogram (1 hr)

UNIT V **4 Hours**

Urinary System

Anatomy of the urinary tract with special reference to the anatomy of kidney and nephrons (2hrs)

Physiology of urine formation, micturition reflex and role of kidneys in acid-base balance, Role of RAAS in kidney (2 hrs)

TEXTBOOKS:

1. Hall JE. Guyton and Hall Textbook of Medical Physiology. 14th edn. Guyton Physiology. WB Saunders, London, England. 2021
2. Tortora GJ, Derrickson B. Principles of anatomy & physiology. 15th edn. Inc. Hoboken, John Wiley & Sons, New Jersey.2017

REFERENCE BOOKS:

1. Susan Standring. (Eds.). Gray's Anatomy: The Anatomical Basis of Clinical Practice.42nd edn. UK: Elsevier, London.2020
2. Barrett KE, Barman SM, Brooks HL, Yuan JJ, (Eds.). Ganong's Review of Medical Physiology,26th edn. McGraw Hill. 2019
3. Vishram Singh. Textbook of Anatomy: Upper limb and Thorax-Volume 1,2 &3 .3rd edn. Elsevier India, New Delhi, India. 2020

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Analysis-I (T)	**2**	**0.5**	**0**	**30**	**2.5**	**I**	**BP102T**
Pharmaceutical Analysis-I (P)	**0**	**0**	**2**	**30**	**1**	**I**	**BP109P**

SCOPE:

The course provides a comprehensive understanding of the analytical techniques and methods used in the pharmaceutical analysis to ensure the quality, safety, and efficacy of drugs.

The course focus on the basic principles and procedures behind the conventional qualitative and quantitative methods of analysis. It mainly focusses on different types titrimetric analysis such as acid base titration, precipitation titration, complex metric titration, diazotisation titration and various types of redox titration. The subject also introduces the fundamentals of electrochemical and gravimetric analysis of drugs.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Describe the definitions, scope and classifications of pharmaceutical analysis

K2: Discuss the fundamental principles behind the qualitative and quantitative analysis

K3: Explain the basic concepts of electrochemical methods and its applicability in qualitative and quantitative analysis.

K4: Describe the fundamentals of the gravimetric analysis and study different parameters influencing the purity of precipitate.

K5: Illustrate the principles behind volumetric analysis

K6: Apply the fundamental methodology for preparing standard solutions.

SKILL

S1: Demonstrate hands-on experience with standard analytical reagents, glass-wares and laboratory instruments.

S2: Perform the preparation of different standard solutions by volumetric method.

S3: Perform the assay of different drugs by volumetric analysis.

S4: Employ electrochemical methods of analysis

S5: Develop skills in pharmaceutical analytical sample preparation and handling different pharmaceutical substances.

S6: Get expertise in handling analytical instruments such as conductometer

ATTITUDE

A1: Develop a high level of professional and ethical code of approach towards analytical practices.

A2: Strengthens the problem solving abilities by involving in various complex sample analysis protocols and troubleshooting the issues that arise during the analysis process.

A3: Impart critical thinking skills, analytical calculations require critical thinking skills to interpret the results.

A4: Provides a positive attitude towards inquiry, analysis, and evidence-based decision-making

A5: Exhibit professionalism in the working environment.

A6: Inspire students to pursue further research and innovation in pharmaceutical analysis, fostering a positive attitude towards creativity, exploration, and staying updated with advancements in the field.

COURSE CONTENTS

UNIT I **5 Hours**

Pharmaceutical Analysis-Definition and Scope

Different techniques of analysis (1hr)

Primary and secondary standards. (1hr)

Errors**:**

Sources of errors, types of errors, methods of minimizing errors (1hr)

ccuracy, precision and significant figures (1hr)

Methods of expressing concentration:

Calculation of number of moles, molarity, normality, molality, percentage concentration, parts per million and serial dilution. (1hr)

UNIT II **6 Hours**

Basic Titrimetric Analysis

Acid base titration**:**

Theories of acid base indicators (1hr)

Classification of acid base titrations (1hr)

Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves. (1 hr)

Selection of indicators in acid base titration (1 hr)

Non aqueous titration**:**

Solvents (1 hr)

Estimation of Sodium benzoate and Ephedrine HCl. (1 hr)

UNIT III **7 Hours**

Miscellaneous Titrimetric Analysis

Precipitation titrations: Basic principles and classification, Mohr's method, Volhard's, Modified Volhard's, Fajans method. (2 hrs)

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents. (2 hrs)
Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation (2 hrs)
Diazotisation titration: Basic principles, methods and applications (1 hr)

UNIT IV **5 Hours**

Redox Titrations

Concepts of oxidation and reduction (2 hrs)
Types of redox titrations (principles and applications)
Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate (3 hrs)

UNIT V **7 Hours**

Electrochemical Methods of Analysis

Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications. (1 hr)

Potentiometry - Electrochemical cell, construction and working of reference and indicator electrodes, methods to determine end point of potentiometric titration and applications. (3 hrs)

Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications (3 hrs)

LIST OF EXPERIMENTS

I. Preparation and standardization of

1. Sodium hydroxide
2. Sulphuric acid
3. Sodium thiosulfate
4. Potassium permanganate
5. Ceric ammonium sulphate

II. Assay of the following compounds along with Standardization of Titrant

1. Ammonium chloride by acid base titration
2. Ferrous sulphate by Cerimetry
3. Copper sulphate by Iodometry
4. Calcium gluconate by complexometry
5. Hydrogen peroxide by Permanganometry
6. Sodium benzoate by non-aqueous titration
7. Sodium Chloride by precipitation titration

III. Determination of Normality by electro-analytical methods

1. Conductometric titration of strong acid against strong base
2. Conductometric titration of strong acid and weak acid against strong base
3. Potentiometric titration of strong acid against strong base

TEXT BOOKS:

1. Vogel, Arthur I. Quantitative inorganic analysis. 6th Edn. Pearson. 2009
2. Beckett, A. H., and J. B. Stenlake. Practical pharmaceutical chemistry: Part two. 4th Edn, Athlone Press University of London.2005.
3. Driver, John Edmund. Bentley & Driver's text-book of pharmaceutical chemistry. 8th Edn. 2020.
4. Rao, P. Gundu. Inorganic pharmaceutical chemistry. Vallabh Prakashan, Delhi. 2020.

REFERENCE BOOKS:

1. Kennedy, John H., and John H. Kennedy. Analytical chemistry: principles. Harcourt Brace Jovanovich, 2011.
2. Indian Pharmacopoeia. “Government of India ministry of health and family welfare, published by Indian Pharmacopoeial commission”." *Government of India Ghaziabad* 2022.
3. European pharmacopoeia. European Directorate for the Quality of Medicine & Health Care of the Council of Europe (EDQM), 2023.

**Latest edition of text books and reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutics-I (T)	**3**	**0**	**0**	**30**	**3**	**I**	**BP103T**
Pharmaceutics-I (P)	**0**	**0**	**3**	**30**	**1.5**	**I**	**BP110P**

SCOPE:

This course is designed to impart fundamental knowledge on the art and science of handling prescriptions and dispensing medications correctly considering the different dose requirements based on various factors. It is essential for the students to know the history of the pharmacy profession and pharmaceutical industry in India and appreciate their current status. In order to learn the different dosage forms and their preparations, an understanding of the untoward interactions between chemicals in pharmaceutical preparations arising due to the incompatibility of various types is essential. It is also important to know the methods to overcome them as well as the basic and important pharmaceutical calculations.

This course will enable the students to differentiate the different liquid dosage forms as well as the semisolid and powder dosage forms based on their formulation, preparation, uses etc. The different official books of standards (Pharmacopoeias) and their evolvement and importance are also covered.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to

KNOWLEDGE

K1: Outline the historical background, development, and current status of the profession of pharmacy, pharma industry as well as various pharmacopeias (Remember)
K2 : Describe the different parts of prescription and the various factors affecting doses of drugs (Remember)
K3 : Classify the different types of dosage forms and incompatibilities between ingredients (Comprehension)
K4 : Distinguish between the monophasic and biphasic liquid dosage forms in terms of the types, preparation, formulation etc. (Analysis)
K5: Summarize the powders and the semisolid dosage forms considering their advantages, disadvantages, preparation, excipients used etc. (Synthesis)
K6: Interpret the English meaning of the Latin terms commonly used in prescriptions (Evaluation)

SKILL

S1: Handle different weighing and measuring techniques required for dispensing prescriptions

S2: Demonstrate the preparation of different solid powder dosage forms
S3: Estimate the amount of drug required to prepare solutions of required strength
S4: Perform the preparation, packing, and labeling of various semisolid dosage forms
S5: Design suitable liquid dosage form for the given drug
S6: Apply various methods for altering the strength and adjusting the tonicity of solutions.

ATTITUDE

A1: Follow appropriate measures to correctly dispense the given prescription
A2: Cooperate with fellow students for mutual well being
A3: Praise the efforts of faculty and supporting staff who facilitate your learning
A4: Accept good laboratory practices while performing the preparation of various dosage forms
A5: Display sincerity, punctuality, and integrity
A6: Demonstrate interest, motivation, and self-evaluation for learning beyond classroom

COURSE CONTENTS

UNIT I **10 Hours**

Historical background and development of the profession of pharmacy:

History of the profession of Pharmacy in India in relation to pharmacy education, industry and organization, its current status and Pharmacy as a career (2 hrs)

Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia (2hrs)

Dosage forms: Introduction to dosage forms, classification (2hrs)

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription, Introduction to commonly used Latin terms. (2hrs)

Posology: Definition, Factors affecting posology. Pediatric dose calculations are based on age, body weight, and body surface area. (2hrs)

UNIT II **12 Hours**

Pharmaceutical calculations:

Weights and measures – Imperial & Metric system, Calculations involving percentage strengths (4 hrs)

allegation, proof spirit, and isotonic solutions based on freezing point and molecular weight (3hrs)

Powders: Definition, classification, advantages and disadvantages, Simple & compound powders –official preparations, dusting powders, effervescent, efflorescent, and hygroscopic powders, eutectic mixtures. Geometric dilutions (3hrs)

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in the formulation of liquid dosage forms (2hrs)

UNITIII **12 Hours**

Monophasic liquids:

Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Ear drops, Nasal drops (2hrs)

Definitions and preparations of Enemas, Syrups, Elixirs, Liniments, and Lotions (2 hrs)

Biphasic liquids:

Suspensions:

Definition, advantages and disadvantages, classifications, Flocculated and Deflocculated suspension (2 hrs)

Formulation and Preparation of suspensions (2 hrs)

Emulsions:

Definition, classification, and test for the identification of the type of Emulsion (1hr)

Formulation of suspension (2 hrs)

Methods of preparation (1 hr)

UNIT IV **4 Hours**

Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIT–V **7 Hours**

Semisolid dosage forms: Definitions, classification. Excipients used in semisolid dosage forms (2 hrs)

Preparation and evaluation of ointments, pastes, creams and gels (5hrs)

LIST OF EXPERIMENTS

Preparation, packing, labeling, and dispensing of the following dosage forms against the given prescriptions

1. Syrups

a) SyrupIP'66

b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

a) Piperazine citrate elixir

b) Paracetamol pediatric elixir

3. Linctus

a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate

b) Cresol with soap solution

c) Lugol's solution

5. Suspensions

a) Calamine lotion

b) Magnesium Hydroxide mixture

c) Aluminimum Hydroxide gel

6. Emulsions

a) Castor oil emulsion

b) Turpentine Liniment

c) Liquid paraffin emulsion

d) Arachis oil emulsion

7. Powders and Granules

a) ORS powder (WHO)

b) Effervescent granules

c) Dusting powder

d) Divided powders

8. Semisolids

a) Sulphur ointment

b) Non-staining iodine ointment with methyl salicylate

c) Carbopol gel

9. Gargles and Mouthwashes

a) Iodine gargle

b) Chlorhexidine mouthwash

TEXT BOOKS

1. Carter S J. Cooper and Gunn's Dispensing for Pharmaceutical Students. 12th edn. CBS Publishers & Distributors New Delhi; 2008.
2. Seth A K. A textbook of Pharmaceutics. 2nd edn. S Vikas & Co. Jalandhar; 2017.

REFERENCE BOOKS

1. Ansel H C. Pharmaceutical calculations. 14th edn. Lippincott Williams & Wilkins, New Delhi; 2013.
2. Carter S J. Cooper and Gunn's Tutorial Pharmacy. 6th edn. CBS Publishers & Distributors New Delhi; 2009.
3. Khar R K. Lachman/Liberman's Theory and Practice of Industrial Pharmacy. 4th edn. CBS Publishers & Distributors New Delhi; 2013.
4. Latest edition of Indian Pharmacopoeia

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Inorganic Chemistry (T)	**2**	**0.5**	**0**	**30**	**2.5**	**I**	**BP104T**
Pharmaceutical Inorganic Chemistry (P)	**0**	**0**	**2**	**30**	**1**	**I**	**BP111P**

SCOPE: The subject emphasizes the history of pharmacopoeia, monographs of pharmaceutical inorganic compounds, various sources of inorganic impurities and methods to determine it. It also specifies various electrolytes, their significance in combination and replacement therapy. It describes the preparation, properties, identification tests and storage conditions of pharmaceutical inorganic compounds.

It covers important aspects on buffer equation, buffer capacity, significance of buffers in pharmaceutical systems, buffer systems involved in maintaining physiological acid base balance. The subject also illustrates the significance, properties, storage conditions, precautions and pharmaceutical applications of radioactive substances.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Outline the history of pharmacopoeia and structure of monograph of a drug (Remembering)
K2: Explain various sources of impurities in pharmaceutical preparations (Understanding)
K3: Interpret the significance of limit test in determining impurities in inorganic drugs and pharmaceuticals (Understanding)
K4: Differentiate various electrolytes and their significance in combination and replacement therapy. **(**Understanding**)**
K5: Interpret buffer equation, buffer capacity, significance of buffers in pharmaceutical systems and buffer systems involved in maintaining physiological acid base balance (Understanding)
K6: Discuss the preparation, properties, identification tests and storage conditions of pharmaceutical inorganic compounds. (Understanding)
K7: Illustrate the significance, properties, storage conditions, precautions and pharmaceutical applications of radioactive substances. (Understanding)

SKILL
S1: Perform test for purity to find out the purity of Bentonite (Applying)
S2: Assess the neutralizing capacity of Aluminium hydroxide Gel (Applying)
S3: Prepare various inorganic compounds of pharmaceutical importance (Applying)
S4: Detect the presence of chloride, sulphate, iron and Arsenic impurities present in the sample (Analyzing)

S5: Test the presence of chloride and sulphate impurities in the sample by modified limit test. (Analyzing)
S6: Identify the unknown inorganic anion/cation present in the sample (Analysing)

ATTITUDE

A1: Appreciate the knowledge of the course in relating the properties, uses and storage conditions of various Inorganic pharmaceutical preparations.
A2: Follow professionalism in the working environment
A3: Participate in group discussions to plan effectively in performing experiments.
A4: Exhibit good communication skills to emerge as compassionate pharmacy professionals.
A5: Assist the fellow students in executing the experiments.
A6: Support the other students in updating knowledge in the subject.

COURSE CONTENTS

UNIT I **6 Hours**

Impurities in Pharmaceutical Substances
Sources and types of impurities, Limit tests (1hr)
Monographs (1hr)
Principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals (3 hrs)
Modified limit test for Chloride and Sulphate. (1hr)
(Sources and types of impurities (with 2/3 examples))

UNIT II **8 Hours**

Buffers
Buffer equations and buffer capacity in general (1hr)
Preparation, stability (1hr)
Buffered isotonic solutions, tonicity- measurements, calculations, adjusting isotonicity(1 hr)
(Buffers in pharmaceutical systems)
General methods of preparation, assay for the compounds superscripted with an asterisk (*), properties, medicinal uses and storage conditions of inorganic compounds belonging to the following classes.
Major extra and intracellular electrolytes:
Physiological acid-base balance. (1hr)
Electrolytes used in replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS)(1 hr)
(Functions of major physiological ions)
Dental products:
Dentifrices, the role of fluoride in the treatment of dental caries, Desensitizing agents(1hr)
(Strontium Chloride, Zinc Chloride, Calcium carbonate, Sodium fluoride, Zinc eugenol cement)

UNIT III **5 Hours**

Gastrointestinal Agents

Acidifiers: Ammonium chloride* and Dil. HCl (1hr)
Antacid: Ideal properties of antacids, Sodium Bicarbonate*, Aluminium hydroxide gel, and Magnesium hydroxide mixture. (1 hr)
Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations. (1hr)
Cathartics: Definition, mechanism(1hr)
(Combinations antacids - Compound magnesium trisilicate oral powder, Magnesium trisilicate mixture, Compound magnesium trisilicate tablets-composition Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite)

UNIT IV **6 hours**

Miscellaneous Compounds

Expectorants: Potassium iodide, Ammonium chloride*(1 hr)
Emetics: Copper sulphate*, Sodium potassium tartrate(1hr)
Haematinics: Ferrous sulphate*, Ferrous gluconate (1 hr)
Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite 333(1hr)
Astringents: Zinc Sulphate, Potash Alum(1 hr)

UNIT V **5 Hours**

Radiopharmaceuticals

Radioactivity, Measurement of radioactivity, (1hr)
Properties of α, β, γ radiations, Half-life, (1hr)
Radio isotopes and study of radioisotopes - Sodium iodide I131-preparation(1hr)
(Storage conditions, precautions & pharmaceutical application of radioactive substances.)

LIST OF EXPERIMENTS

I. Limit tests

1. Detect the chloride impurity present in the given sample by Limit test for Chloride
2. Detect the Sulphate impurity present in the given sample by Limit test for Sulphates
3. Detect the Iron impurity present in the given sample by Limit test for Iron
4. Detect the Arsenic impurity present in the given sample by Limit test for Arsenic
5. Test the presence of Chloride and Sulphate impurities in the sample by Modified Limit test for Chlorides & Sulphates

II. Identification Tests

1. Identify the given sample of Magnesium hydroxide
2. Identify the given sample of Ferrous sulphate
3. Identify the given sample of Sodium bicarbonate

III. Preparation of Inorganic Pharmaceuticals

1. Prepare Boric acid, calculate the percentage practical yield and report.
2. Potash Alum, calculate the percentage practical yield and report.
3. Ferrous Sulphate, calculate the percentage practical yield and report.

IV. Test for purity

1. Perform the test for purity of Bentonite
2. Assess the Neutralizing capacity of aluminium hydroxide gel

TEXT BOOKS:

1. Atherden LM. Bentley and Driver's Textbook of Pharmaceutical Chemistry. 8th edn. India: Oxford;2020
2. Chatwal GR. Pharmaceutical Chemistry-Inorganic. 5th edn. Himalaya Publishers. India; 2021(Theory &Practical)
3. Alagarsamy V. Pharmaceutical Inorganic Chemistry. 2nd edn. PharmaMed Press. India; 2022 (Practical)

REFERENCE BOOKS:

1. J Mendham, R C Denny, J D Barnes, M Thomas & B Sivasankar. Vogel's textbook of quantitative chemical analysis. 6th edn. Pearson Education. Germany; 2009.
2. P. Gundu Rao. Inorganic Pharmaceutical Chemistry. 1st edn. Vallabh Prakshan, India; 2008 (Practical)
3. Vogels Textbook of Quantitative Chemical Analysis. India: Pearson Education; 2006.

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Communication Skills (T)	**2**	**0**	**0**	**30**	**2**	**I**	**BP105T**
Communication Skills (P)	**0**	**0**	**2**	**30**	**1**	**I**	**BP112P**

SCOPE:

Communication Skills training will equip the students to communicate effectively in their work and personal space. It enables students to direct, plan, organize and control the communication process thereby working cohesively with the team as a team player and add value to the pharmaceutical field.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course the student shall be able to:

KNOWLEDGE:

K1: Define the nature of the communication. (Remembering)

K2: Review the norms associated with effective communication. (Remembering)

K3: Recognize the various Perspectives in Communication. (Remembering)

K4: Identify the numerous barriers hindering Effective Communication. (Remembering)

K5: Distinguish the requirements for an efficient Verbal and Non Verbal Communication. (Understanding)

K6: Differentiate the Do's and Don'ts associated with the different types of communication. (Understanding)

SKILLS

S1: Apply the learning to frame effective business Written Communication. (Applying)

S2: Compose formal emails, expose good Interview Etiquettes and communicate effectively in business scenarios and with healthcare professionals. (Applying)

S3: Examine the nuances of words and pronunciation. (Applying)

S4: Determine the requirements for the various types of Communication. (Analysing)

S5: Prepare Effective Written materials. (Analysing)

S6: Perform skillfully in Interviews and Group Discussions. (Analysing)

ATTITUDES

A1: Appreciate the knowledge of the course in communicating effectively with others in both personal and professional space,

A2: Participate in Group Discussions and other classroom communication activities.

A3: Exhibit skills to express thoughts and ideas accurately.

A4: Corporate with other healthcare professionals using excellent communication skills to add value to the pharmaceutical field.

A5: Assist teammates in group activities as required.

A6: Support teammates by encouraging them and compassionately aiding them when required.

COURSE CONTENTS:

UNIT – I **7 Hours**

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context, Marketing Communication- Message Senders, Message Communication Channel, Message Receivers. (3 hrs)

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers. (2 hrs)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affectingour perspective - Past Experiences, Prejudices, Feelings, Environment, Patient Centered Communication- Communication with Empathy, Collaboration with Other Health Professionals, Handling Conflicts, Avoiding Communication Mishaps (2 hrs)

UNIT – II **7 Hours**

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication. (3 hrs)

Communication Styles: Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.(4 hrs)

UNIT – III **7 Hours**

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations. (2 hrs)

Effective Written Communication: Introduction, When and When Not to Use Written Communication- Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication. (3 hrs)

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message, Etiquette in E-mail Writing.(2 hrs)

UNIT – IV **5 Hours**

Interview Skills: Purpose of an Interview, Do's and Don'ts of an Interview, Communication for Interview- Self Introduction, Body Language, Interview Etiquette. (3 hrs)

Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery. (2 hrs)

UNIT – V **4 Hours**

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of Group discussion. (4 hrs)

LIST OF EXPERIMENTS

The following learning modules are to be conducted using words worth® English language lab software.

1. **Basic communication covering the following topics**

a. Meeting People

b. Asking Questions

c. Making Friends

d. What did you do?

e. Do's and Don'ts

2. **Pronunciations covering the following topics:**

a. Pronunciation (Consonant Sounds)

b. Pronunciation and Nouns

c. Pronunciation (Vowel Sounds)

3. **Advanced Learning**

a. Listening Comprehension / Direct and Indirect Speech

b. Figures of Speech

c. Effective Communication

d. Writing Skills

e. Effective Writing

f. Interview Handling Skills

g. E Mail etiquette

h. Presentation Skills

4. **Additional Activities**:

a. Role Play

b. Debate

c. Letter Writing

d. Story writing

e. Story Re-telling

f. Quiz games.

TEXT BOOKS:

1. Dr. Pragi Arora, Dr. Varun Arora, Dr. Jagdeep Singh Dua, Davinder Kumar**.** Communication Skills (For B.Pharmacy 1st Semester as per syllabus issued by Pharmacy Council of India, New Delhi), PV Books, Punjab, 2017.
2. Sanjay Kumar, Pushpalata. Communication skills, 2nd edn, Oxford University Press, New Delhi, 2015.
3. Gopala Swamy Ramesh, Mahadevan Ramesh. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, 5th edn, Pearson, 2013.

REFERENCE BOOKS:

1. Organizational Behaviour, Stephen .P. Robbins, 1st edn, Pearson, 2013.
2. Andreja. J. Ruther Ford. Basic communication skills for Technology, 2nd edn, Pearson Education, 2011.
3. Gill Hasson. Brilliant- Communication skills, 1st edn, Pearson Life, 2011.
4. Gopala Swamy Ramesh, Mahadevan Ramesh. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, 5th edn, Pearson, 2013.
5. Deborah Dalley, Lois Burton, Margaret, Green hall. Developing your influencing skills, 1st edn Universe of Learning LTD, 2010

**Latest edition of text books and reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Remedial Mathematics (T)	**2**	**0**	**0**	**30**	**2**	**I**	**BP106RMT**

SCOPE:

This is an introductory course in mathematics. This subject deals with the introduction to Sets, Matrices, Relations and Functions, Permutations and Combinations, Sequences and Series, Mathematical Reasoning.

Calculus is a significant mathematic tool for investigating drug movement quantitatively. Differential equations are used to relate the absorptions of drugs in various body organs over time. Integrated equations are regularly used to model the cumulative therapeutic or toxic reactions of drugs in the body.

COURSE LEARNING OUTCOMES:

Upon completion of the course the student shall be able to;

KNOWLEDGE

K1: Define set theory in mathematics
K2: Classify different types of matrices
K3: Illustrate relations and functions in set theory
K4: Describe the relationship between Arithmetic Mean (A.M) and Geometric Mean (G.M)
K5: Explain statements and compound statements in mathematical reasoning
K6: Describe the rules of integration.

SKILL

S1: Construct Venn diagram.
S2: Interpret matrix multiplication.
S3: Determine Cartesian products of sets.
S4: Sum to terms of special series.
S5: Construct new statements from old statements.
S6: Apply Method of substitution and Method of Partial fractions in integration.

ATTITUDE

A1: Appreciate the work of others.
A2: Share and care for good harmony and work culture.
A3: Follow the mathematical theories and rules in a correct manner for getting accurate results.
A4: Participate actively in the class room activities.
A5: Support other students for mutual improvement.
A6: Demonstrate sincerity and punctuality.

COURSE CONTENTS

UNIT I **6 Hours**

Sets

Introduction, Sets and their Representations (1 hr)
The Empty Set, Finite and Infinite Sets (1 hr)
Equal Sets, Subsets (1 hr)
Power Set, Universal Set (1 hr)
Venn Diagrams, Operations on Sets (1 hr)
Complement of a Set, Practical Problems on Union and Intersection of Two Sets (1 hr)

UNIT II **6 Hours**

Matrices

Introduction matrices, Types of matrices (1 hr)
Operation on matrices (1 hr)
Transpose of a matrix (1 hr)
Matrix Multiplication (1 hr)
Properties of matrix addition and multiplication (1 hr)
Symmetric and skew-symmetric matrices, Invertible matrices (1 hr)

UNIT III **3 Hours**

Relations and Functions

Introduction, Cartesian Product of Sets (1 hr)
Relations (1 hr)
Functions (1 hr)

UNIT IV **6 Hours**

Sequences and Series

Introduction, Sequences (1 hr)
Series (1 hr)
Arithmetic Progression (A.P.) (1 hr)
Geometric Progression (G.P.) (1 hr)
Relationship between Arithmetic Mean (A.M) and Geometric Mean (G.M) (1 hr)
Sum to n terms of Special Series (1 hr)

UNIT V **3 Hours**

Mathematical Reasoning

Introduction, Statements (1 hr)
New Statements from Old, Special Words/Phrases (1 hr)
Implications, Validating Statements (1 hr)

UNIT VI **6 Hours**

Calculus

Differentiation: Introductions, Derivative of a function, Derivative of a constant (1 hr)

Derivative of a product of a constant and a function, Derivativeof the sum or difference of two functions (1 hr)

Derivative of the product of twofunctions (product formula), Derivative of the quotient of two functions (Quotient formula) – Without Proof (1 hr)

Integration: Introduction, Definition (1 hr)

Standard formulae, Rules of integration (1 hr)

Method of substitution, Method of Partial fractions (1 hr)

TEXT BOOKS:

1. Mathematics Textbook for Class 11& 12, NCERT

REFERENCE BOOKS:

1. R. D Sharma, Mathematics class XI, Volume 1, Dhanpat Rai Publication
2. R.S. Aggarwal, Mathematics Class 11, Bharti Bhavan

**Latest edition of text books and reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Remedial Biology (T)	**2**	**0**	**0**	**30**	**2**	**I**	**BP106RBT**

SCOPE: This subject is designed to provide fundamental knowledge about the various organ system and functions of the human body. This course deals with the fundamental aspects of living organisms, their classification, salient features, structure, and function of cell and cell organelles, morphological and physiological process of the plants and animals.

It provides the foundation necessary to comprehend core pharmacy subjects like pharmacology and pharmacognosy. It helps students to develop the skills to distinguish different plant tissues based on their microscopic characters. This course will enable the students to understand the concept of species and taxonomical hierarchy and five kingdom classification.

COURSE LEARNING OUTCOMES:

On successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Describe the structure, and function of cell and cell organelles**.**
K2: Discuss the classification and salient features of the five kingdoms of life.
K3: Describe the anatomy and functions of different parts of flowering plants**.**
K4: Explain the physiological process of the plant.
K5: Explain the functions associated with various organs of the human body.
K6: Explain the coordinated working pattern of different organs of each system.

SKILLS

S1: Identify the modified plant organs based on their characteristic features.
S2: Enumerate the types, functions, and location of epithelial cells.
S3: Assess the role of plant hormones in the physiological processes.
S4: Identify members different Kingdom based upon their features.
S5: Differentiate between artery and vein.
S6: Communicate effectively to convey ideas and information clearly and appropriately.

ATTITUDES

A1: Participate actively in discussions.
A2: Accept responsibility.
A3: Demonstrate regularity and punctuality in class.
A4: Cultivate critical thinking skills.
A5: Develop a commitment to continuous learning.
A6: Acquire the ability to gather, evaluate, and interpret relevant information.

COURSE CONTENTS

UNIT–I **4 Hours**

Taxonomy & Systematics

Concept of species and taxonomical hierarchy; Binomial nomenclature. (1 hr)

Salient features and classification of plants into major groups:

Algae, Bryophytes, Pteridophytes, Gymnosperm, and Angiosperm (three to five salient and distinguishing features and at least two examples of each category) (2 hrs)

Angiosperms- classification up to class, characteristic features, and examples. (1 hr)

UNIT–II **8 Hours**

Cell- The Unit of Life

Structure, Function of Plant and Animal Cell and cell organelles. (1 hr)

cell cycle & cell division. (1 hr)

Plant cell inclusions. (1 hr)

Structure of a human cell, Plasma membrane, and Organelles.(1 hr)

Types, functions, and location of Glandular epithelial cells (1 hr)

Structural Organization in Plants

Morphology and modifications; Tissues, types, location, and its functions; (1 hr)

Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence, flower, fruit, and seed. (2 hrs)

UNIT–III **4 Hours**

Plant Physiology

Transport in plants: Movement of water, gases, and nutrients; Cell-to-cell transport– Diffusion, facilitated diffusion, active transport. (1 hr)

Plant–water relations– Imbibition, water potential, osmosis, plasmolysis; Long-distance transport of water– Absorption, apoplast, symplast, transpiration pull, root pressure, and guttation; .(2 hrs)

Transpiration– Opening and closing of stomata; Uptake and translocation of mineral nutrients– Transport of food, phloem transport, Diffusion of gases. Growth regulators–auxin, gibberellin, cytokinin, ethylene, ABA.(2 hrs)

UNIT–IV **9 Hours**

Human Physiology

Body fluids and circulation

Composition of the blood, lymph, Disorders of blood, and Structure of blood vessels.(1 hr)

Differences between artery and vein Blood vessels of vital organs, Heart sound, and Disorders of the cardiovascular system.(1 hr)

Neural control and coordination

Organization of the nervous system, Neurons, types of neurons, classification, and properties of the nerve fibre. (1 hr)

Classification of the peripheral nervous system, Structure, and functions of the sympathetic and parasympathetic nervous systems. (1 hr)

Generation and conduction of nerve impulse, Reflex action; Sensory perception. (1 hr)

Respiration

Mechanism of breathing and its regulation in humans– Exchange of gases, transport of gases and regulation of respiration. (1 hr)

Artificial respiration, Resuscitation methods. (1 hr)

Digestion and absorption

Alimentary canal and digestive glands; Role of digestive enzymes and gastrointestinal hormones; (1 hr)

Peristalsis, digestion, absorption, and assimilation of proteins, carbohydrates, and fats. (1 hr)

UNIT–V (5 hours)

Excretory products and their elimination

Modes of excretion – Ammonotelism, ureotelism, uricotelism; Human excretory system– structure and function of kidney and nephron. (1 hr)

Regulation of kidney function– Renin-angiotensin, Atrial Natriuretic Factor, ADH, and Diabetes insipidus; Role of other organs in excretion. (1 hr)

Chemical coordination and regulation

Endocrine glands and hormones; Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads. (1 hr)

Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo-and hyperactivity and related disorders (examples only). (1 hr)

Reproductive system

Genetic basis of sex determination, Primary and secondary sex organs, Role of sex hormones in reproductive development. (1 hr)

TEXT BOOKS:

1. Ghose KC, Manna B. Fundamental of Zoology. 1st edn. New Central book agency Pvt. Ltd, Kolkata, 2003.
2. Randhawa SS, Atul Kabra. 2nd edn. Remedial Biology. S Vikas and Company Pvt. Ltd., New Delhi, 2009

REFERENCE BOOKS:

1. Gokhale SB, Kokate CK, Bidarkar DS. Pharmaceutical Biology. Nirali Prakashan, Pune, 2007.
2. Dutta AC, Dutta TC. Botany for Degree Students. 6th edn. Oxford University Press, India, 2013.
3. Kokate CK, Purohit, Gokhlae. Textbook of Pharmacognosy. 37th edn. Nirali Prakashan, New Delhi, 2007.
4. Pandey PB. Botany for Degree Students. 2nd edn. S Chand & Company Pvt.Ltd., New Delhi, 2009

**Latest edition of text books and reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Foundations of Indian Heritage - Theory (T)	**2**	**0**	**0**	**30**	**2**	**I**	**22ADM101**

SCOPE: To introduce students to the depths and richness of the Indian culture and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

COURSE OUTCOMES

CO1: Increase student understanding of true essence of India's cultural and spiritual heritage. Emancipating Indian histories and practices from manipulation, misunderstandings, and other ideological baggage thus, shows its contemporary relevance.

CO2: Understand the ethical and political strategic concepts to induce critical approach to various theories about India.

CO3: Familiarize students with the multidimension of man's interaction with nature, fellow beings and society in general.

CO4: Appreciate the socio-political and strategic innovations based on Indian knowledge systems. Gives an understanding of bringing Indian teaching into practical life

COURSE CONTENTS

Unit 1 – Unit 4 **6 hours**

Educational Heritage of Ancient India
Life and Happiness
Impact of Colonialism and Decolonization
A timeline of Early Indian Subcontinent

Unit- 5 – 8 **8 hours**

Pinnacle of Selflessness and ultimate freedom
Indian approach towards life
Circle of Life
Ocean of love; Indian Mahatmas.

Unit 9 – 13 **8 hours**

Man's association with Nature
Celebrating life 24/7.
Metaphors and Tropes
Become A Strategic Thinker (Games / Indic activity)
India: In the Views of Other Scholars and Travellers

Unit 14-16 **8 hours**

Personality Development Through Yoga.
Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness
Conversations on Compassion with Amma

TEXTBOOKS

Foundations of Indian Heritage

REFERENCE BOOKS

1. The beautiful tree by Dharampal
2. Peasants and Monks in British India by William Pinch
3. India, that is Bharat: Coloniality, Civilisation, Constitution by J Sai Deepak
4. Awaken Children Dialogues with Mata Amritanandamayi
5. Man and Nature by Mata Amritanandamayi Devi
6. What Becomes of the Soul After Death, Divine Life Society

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Mastery Over Mind (MAOM) (T)	**2**	**0**	**0**	**15**	**1**	**I**	**22AVP103**

SCOPE:

Mastery Over the Mind (MAOM) is an Amrita initiative to implement schemes and organize university-wide programs to enhance health and wellbeing of all students. This program as part of our efforts for sustainable stress reduction gives an introduction to immediate and long-term benefits and equips every attendee to manage stressful emotions and anxiety facilitating inner peace and harmony. The meditation technique offered by Amrita University Chancellor and world-renowned humanitarian and spiritual leader, Sri Mata Amritanandamayi Devi (Amma), is completely dedicated for guided practical meditation session and theory aspects of MAOM. The theory section comprises principle of meditation, stress management, research and science of meditation, principles of conscious communication.

This course promotes a sense of control and autonomy in the Universal Human Value System, compassion, empathy, responsibility and practicing meditation for the wholesome wellbeing of an individual. This course enhance the understanding of experiential learning based on university's mission: "Education for Life along with Education for Living", and is aimed to allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals. During practice session students are trained through guided meditation session of different level. They experience Mind and body relaxation, get rid of energy blockage, pure unconditional love, light of consciousness, positive energy and compassion.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, student shall be able to;

KNOWLEDGE

K1: Discuss Principles of meditation

K2: Explain basics of stress management

K3: Summarize the role of mastery over mind in developing compassion

K4: Analyze the correlation between relationships and empathy

K5:Criticize consequences of stress.

K6:Relate the global transformation through meditation

SKILL

S1: Practice of MA-OM meditation technique that is effective in one's life

S2: Assimilate higher level of awareness and focus.
S3: Demonstrate meditation for stress and anxiety reduction.
S4: Comment on the research and science of meditation:
S5: Perform Skill fully meditation.
S6. Assess the effect of practicing meditation.

ATTITUDE

A1: Appreciate the work of others.
A2: Be sincere and devoted.
A3: Empathize and be humble
A4: Participate actively in the discussions during class.
A5: Support your team members for better outcomes.
A6: Share and care for good harmony and work culture.

COURSE CONTENTS

UNIT 1 **4 Hours**

Causes of Stress

The problem of not being relaxed. Need for meditation. Basics of stress management at home and workplace. (1 hr)
Traditions and Culture, Principles of meditation, (1hr) Promote a sense of control and autonomy in the Universal Human Value System. (1 hr)
Different stages of Meditation. Various Meditation Models. Various practices of Meditation techniques in different schools of philosophy and Indian Knowledge System. (1 hr)

UNIT II **5 Hours**

Improving work and study performance

Meditation in daily life. Cultivating compassion and good mental health with an attitude of openness and acceptance. (1hr)
Research and Science of Meditation: Significance of practicing meditation and perspectives from diverse fields like science, medicine, technology, (1hr) philosophy, culture, arts, management, sports, economics, healthcare, environment etc. (1hr)
The role of meditation for stress and anxiety reduction in one's life with insights based on recent cutting-edge technology. (1hr)
The effect of practicing meditation for the wholesome wellbeing of an individual. (1hr)

UNIT III **5 Hours**

Self communications

Principles of conscious communication. Relationships and empathy. Meditative approach in managing and maintaining better relationships in life during the interactions in the world(1hr)
Role of MAOM in developing compassion, empathy and responsibility, (1hr)

Instilling interest, and orientation to humanitarian projects as a key to harness intelligence and compassion in youth. (1hr)
Methodologies to evaluate effective awareness and relaxation gained from meditation. (1hr)
Evaluating the global transformation through meditation by instilling human values which leads to service learning and compassion driven research. (1hr)

Practice Session:
During practice sessions, students are trained through guided meditation of different levels. It starts with the relaxation of the body through step-by-step instructions. This helps them to relax physically. They are then instructed to focus on their breathing, which helps them relax and focus. Students are then instructed to keep their attention on their thoughts, followed by inhalation and exhalation with the vibration of the sound Ma-Om. This makes them experience stillness and inner expansiveness. Finally, they are instructed to practice White Flower Meditation for global peace and harmony. Through this White Flower meditation, they can connect with the universe and experience oneness.

TEXT BOOKS:

1. Mata Amritanandamayi Devi, "Cultivating Strength and vitality," published by Mata Amritanandamayi Math, Dec 2019
2. Swami Amritaswarupananda Puri ,"The Color of Rainbow " published by MAM, Amritapuri.(latest edition)

REFERENCES:

1. Craig Groeschel, "Winning the War in Your Mind: Change Your Thinking, Change Your Life" Zondervan Publishers, February 2019
2. Swami Amritaswarupananda Puri "Awaken Children Vol 1, 5 and 7 - Dialogues with Amma on Meditation", August 2019
3. Secret of Inner Peace- Swami Ramakrishnananda Puri, Amrita Books, Jan 2018.

**Latest edition of text books and reference books can be referred*

SEMESTER-II

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Human Anatomy And Physiology - II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**II**	**BP201T**
Human Anatomy And Physiology - II (P)	**0**	**0**	**2**	**30**	**1**	**II**	**BP207P**

SCOPE: The Course's primary goal is to learn how the different bodily systems work together to maintain homeostasis. By understanding the interconnected mechanisms involved in homeostasis, students can appreciate how various processes are controlled and balanced within the body. It provides the foundation necessary to comprehend pathophysiology and pharmacology.

Knowledge in the course helps students to develop the skills to determine various body parameters that provide insights into an individual's health status. These skills are important for healthcare professionals to diagnose, monitor, and treat patients effectively. Furthermore, a solid understanding of this course empowers individuals to support the healthcare system and educate the general public about various aspects of health.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Describe the anatomical and physiological terms associated with the human body
K2: Identify the tissues, organs and organ systems in the human body
K3: Outline the disorders that affect various organs of the human body
K4: Discuss the gross anatomy of various organs of the human body
K5: Illustrate the physiological processes involved in the homeostasis of the human body
K6: Explain the interlinked mechanisms involved in the homeostasis of the human body

SKILL

S1: Distinguish the various tissues and organs of the human body
S2: Perform skillfully various blood estimations in humans
S3: Measure heart rate and blood pressure in humans
S4: Determine the body temperature, BMI and blood oxygen levels of humans using various methods
S5: Test the lung capacities of humans using the spirometer
S6: Interpret ECG and Chest X rays of humans
S7: Interpret the laboratory values of humans associated with various diseases states

ATTITUDE

A1: Appreciate the knowledge of Anatomy and Physiology for studying pathophysiology and pharmacology
A2: Communicate with peers and others.
A3: Support and collaborate with others.
A4: Exhibit professionalism in the work environment.
A5: Participate in healthcare initiatives.
A6: Embrace the new advancements in the healthcare system.

COURSE CONTENTS

UNIT I **6 Hours**

Nervous System

Electrophysiology of nerve impulse transmission (1hr)
Receptors, synapses, neurotransmitters, and neuroglia. (2hrs)
Central nervous system: Meninges, brain ventricles, and cerebrospinal fluid (1hr)
Structure and functions of the brain and spinal cord (2hrs)

UNIT II **6 Hours**

Peripheral Nervous System

Origin and functions of spinal and cranial nerves. (2hrs)

Special senses

Anatomy, functions and disorders of the eye (1hr)
ear (1hr)
nose (1hr)
tongue (1hr)

UNIT III **6 Hours**

Digestive System & Respiratory System

Anatomy, functions and disorders of the stomach (1hr), small and large intestine (1hr).
Functions & disorders of pancreas and liver (1hr)
Anatomy, functions and disorders of the lungs (1hr)
Respiration mechanism, respiration regulation, transport of respiratory gases (1hr)
Lung volumes and capacities (1hr)

UNIT IV **6 Hours**

Endocrine System

Classification of hormones, mechanism of hormone action (1hr)
Anatomy, functions and disorders of the:
Pituitary gland (1hr)
Thyroid gland (1hr)
Parathyroid gland (1hr)
Adrenal gland (1hr)
Pancreas (1hr)

UNIT V **6 Hours**

Reproductive System

Anatomy, functions and disorders of,

Male reproductive system (1hr) and Female reproductive system (1hr)

Physiology of menstruation and fertilisation with relevance to the role of hormones (1hr)

Spermatogenesis with relevance to the role of hormones (1hr)

Oogenesis with relevance to the role of hormones (1hr)

Pregnancy and Parturition with relevance to the role of hormones (1hr)

LIST OF PRACTICAL EXPERIMENTS

1. Determination of bleeding and clotting time
2. Estimation of Haemoglobin
3. Determination of blood group
4. Determination of heart rate and pulse rate
5. Recording of BP using various methods
6. Determination of RBC count
7. Determination of WBC count
8. Demonstrate the visual acuity
9. Determine the body temperature
10. Determination of tidal volume and vital capacity using the spirometer
11. Determination of the basal mass index.
12. Determination and interpretation of random blood glucose levels using one touch glucometer
13. Determination and interpretation of ECG
14. Determination and interpretation of blood oxygen level using a pulse oximeter and the need for oxygen therapy.
15. Interpretation of chest X-rays.

TEXT BOOKS:

1. Hall JE. Guyton and Hall Textbook of Medical Physiology. 14th edn. Guyton Physiology. WB Saunders. London, England, 2021
2. Vishram Singh. Textbook of Anatomy: Upper limb and Thorax-Volume 1.3rd edn. Elsevier India. New Delhi, India. 2020
3. Vishram Singh. Textbook of Anatomy: Abdomen and Lower Limb-Volume 2.3rd edn.: Elsevier India. New Delhi, India .2020
4. Vishram Singh. Textbook of Anatomy: Head, Neck and Brain-Volume 3. 3rd edn.: Elsevier India, New Delhi, India. 2020

REFERENCE BOOKS

1. Susan Standring. (Eds.). Gray's Anatomy: The Anatomical Basis of Clinical Practice.42nd edn, UK: Elsevier. London.2020
2. Barrett KE, Barman SM, Brooks HL, Yuan JJ, (Eds.). Ganong's Review of Medical Physiology,26th edn. McGraw Hill.2019
3. Tortora GJ, Derrickson B. Principles of anatomy & physiology. 15th edn. Inc. Hoboken, New Jersey: John Wiley & Sons.2017
4. Deshpande SA, Shirole DS, Amale PN, Vyawahare NS. Practical Book of Human Anatomy and Physiology. 4th edn., Nirali Prakashan, India .2020 (Practical)
5. Goyal RK, Patel NM. (Eds)., Practical Anatomy and Physiology. 17th edn., B S Shah Prakashan, India. 2020

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Organic Chemistry –I (T)	**3**	**0**	**0**	**45**	**3**	**II**	**BP202T**
Pharmaceutical Organic Chemistry –I (P)	**0**	**0**	**3**	**30**	**1.5**	**II**	**BP208P**

SCOPE: This Course deals with the classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions, and methods of preparation of alkyl halides, alcohols, carbonyls, carboxylic acids, and aliphatic amines.

The syllabus emphasizes mechanisms and orientation of reactions such as electrophilic addition, nucleophilic substitution, nucleophilic addition & elimination. This syllabus also includes the structure and medicinal uses, qualitative tests, identifying the preliminary test, and detection of elements, of some organic compounds.

COURSE LEARNING OUTCOME:

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Outline the classification of organic compounds

K2: Explain the general principles of organic reactions and mechanisms like addition, substitution & elimination.

K3: Distinguish the structure and IUPAC name of organic compounds

K4: Interpret the structure, name & types of isomerism of organic compounds

K5: Demonstrate the general methods of preparation, reactivity, and stability of organic compounds

K6: Illustrate the structure and medicinal uses of some organic compounds.

K7: Describe the basic concepts of alkane, alkene, and conjugated dienes

K8: Articulate the basic knowledge regarding alkyl halides, alcohols, carbonyls, carboxylic acids, and aliphatic amines

SKILL

S1: Prepare organic compounds.

S2: Determination of melting point and boiling point of organic compounds

S3: Construct the molecular models of various organic compounds

S4: Identify the preliminary test and detection of elements.
S5: Classify various organic compounds based on their functional groups
S6: Analyse the physico-chemical properties of various organic compounds

ATTITUDE

A1: Appreciate the knowledge of the course about the basic concept of organic compounds.
A2: Follow professional and standard procedures.
A3: Participate in group discussion and the practical sessions.
A4: Follow the SOPs guidelines for the use of lab instruments and equipment's.
A5: Assist fellow students and others in executing the experiments.
A6: Take responsibility for self and group outcomes.

COURSE CONTENTS:

UNIT-I **10 Hours**

Classification, nomenclature and isomerism

Classification of Organic Compounds. (1 hr)
Common and IUPAC systems of nomenclature of organic compounds, alkane and complex substituents. (1 hr)
IUPAC nomenclature of alkene, alkyne, and cyclo alkene(1 hr)
IUPAC nomenclature of functional groups like alcohol, aldehyde, and ketone(1 hr)
IUPAC nomenclature of terminal functional groups like carboxylic acid, acid halide, acid amide, ester, cyanide, amine and ether (1 hr)
IUPAC nomenclature of Polyfunctional groups (1 hr)
Electron displacements in organic chemistry (such as; inductive effect, resonance, hyperconjugation). (1 hr)
Reaction intermediates (such as; freeradicals, carbocations, carbanions, carbenes and nitrenes). (1 hr)
Structural isomerisms in organic compounds. (2 hrs)

UNIT-II **10 Hours**

General methods of preparation of Alkanes, Alkenes, and Conjugated dienes(1 hr)
SP_3 hybridization in alkanes, SP_2 hybridization in alkenes. (1 hr)
Halogenation of alkanes, Stabilities of alkenes, uses of paraffins. (1 hr)
E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocation. E1 vs E2 reactions, Factors affecting E1 and E2 reactions. (2 hrs)
Ozonolysis, Saytzeffs orientation, and evidence. (1 hr)
Electrophilic addition reactions of alkenes, Markownikoffs orientation. (1 hr)
Free radical addition reactions of alkenes, Anti Markownikoff's orientation. (1 hr)
Stability of conjugated dienes, Diel-Alder(1 hr)
Electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement. (2 hrs)

UNIT-III **7 Hours**

General methods of preparation of Alkyl halides***** (1 hr)

SN_1 and SN_2 reactions- kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocation. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions. (2 hrs)

Structure and uses of ethyl chloride, Chloroform, trichloroethylene, and tetrachloroethylene (1 hr)

General methods of preparation of Alcohols*****(1 hr)

Qualitative tests, Structure, and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, and Cetosteryl alcohol, dichloromethane, tetrachloromethane, and iodoform.

Benzyl alcohol, Glycerol, Propylene glycol.(2 hrs)

UNIT-IV **8 Hours**

General methods of preparation of Carbonyl compounds*****(1 hr)

Nucleophilic addition (1 hr)

aldol condensation, Crossed Aldol condensation (1 hr)

Cannizzaro reaction, Crossed Cannizzaro reaction (1 hr)

Benzoin condensation, Perkin condensation (1 hr)

Qualitative tests (1 hr)

Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde. (2 hrs)

UNIT-V **9 Hours**

General methods of preparation of Carboxylic acids*****(1 hr)

Acidity of carboxylic acids, effect of substituents on acidity. (1 hr)

Qualitative tests for carboxylic acids, amide and ester. (1 hr)

Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid, Oxalic acid, Salicylic acid, Benzoic acid(3 hrs)

General methods of preparation of Aliphatic amines*****(1 hr)

Basicity, the effect of substituent on Basicity, Qualitative test. (1 hr)

Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid. (1 hr)

LIST OF EXPERIMENTS:

1. Determination of melting point and boiling point of organic compounds.
2. Detection of elements like nitrogen, sulphur and halogen.
3. Analysis of simple organic compounds I (Amide/urea)
4. Analysis of simple organic compounds II (Phenols)
5. Analysis of simple organic compounds III (Carbohydrates)
6. Analysis of simple organic compounds IV (Amines)
7. Analysis of simple organic compounds V (Carboxylic acid)
8. Analysis of simple organic compounds VI (Aldehydes & Ketones)

9. Analysis of simple organic compounds VII (Alcohols)
10. Analysis of simple organic compounds IX (Halogenated hydrocarbons)
11. Preparation of benzanilide
12. Preparation of salicylic acid
13. Preparation of aspirin
14. Preparation of picric acid
15. Construct the molecular models.

TEXT BOOKS:

1. Morrison, R. T., & Boyd, R. N. *Organic chemistry*. 7th edn. Boston: Allyn and Bacon; 2010.
2. Arun Bahl and B.S. Bahl. A textbook of organic chemistry. 22nd edn. S. Chand; India:2016.
3. P.L. Soni & H. M. Chawla. Textbook of organic chemistry. 29th edn. Sultan Chand & son: India; 2012.

REFERENCE BOOKS:

1. Mann F.G & Saunders B C. Practical organic chemistry. 4th edn. India: Pearson Education India; 2009 (Practical book)
2. Brian S. F, Antony J.H, Peter W.G.S & Austin R.T. Vogel's textbook of Practical Organic Chemistry. 5th edn. Pearson Education India; India: 2003 (Practical book)
3. Clayden J, Greeves N.& Warren S. Organic Chemistry. 2nd edn. Oxford University press; United Kingdom: 2014

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Biochemistry (T)	**2**	**0.5**	**0**	**30**	**2.5**	**II**	**BP203T**
Biochemistry(P)	**0**	**0**	**2**	**30**	**1**	**II**	**BP209P**

SCOPE: The Course is designed to provide a thorough understanding of the molecular level of the chemical processes associated with living cells and the metabolic pathways of nutrient molecules in physiological and pathological conditions. It also emphasizes mammalian genome genetic organization. It also describes the chemical nature and biological role of biomolecules. The Course also gives an idea of the classification of biomolecules based on their structure and functions.

It also gives a clear picture of the concept of bioenergetics and energy-rich compounds. Also describes the metabolic pathways of carbohydrates, lipids, amino acids, and nucleic acids in physiological and pathological conditions. The subject explains various mechanisms involved in biological oxidation and also the kinetics of enzyme action, inhibition, regulation, and applications of enzymes.

COURSE LEARNING OUTCOMES :

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Outline Genetic code and the organization of mammalian genome

K2: Enumerate the IUB classification and properties of enzymes

K3: Explain the chemical nature and biological role of biomolecules.

K4: Classify various biomolecules based on structure and functions.

K5: Discuss the concept of bioenergetics and energy-rich compounds

K6: Interpret the metabolic pathways of carbohydrates, lipids, amino acids and nucleic acids in physiological and pathological conditions

K7: Illustrate the various mechanisms involved in biological oxidation

K8: Explain the kinetics of enzyme action, inhibitors, regulation, therapeutic and diagnostic applications of enzymes.

SKILL

S1: Identify the presence of various amino acids in the sample
S2: Test the presence of proteins in the sample
S3: Analyse qualitatively various samples of Carbohydrates
S4: Detect the presence of abnormal constituents in the urine sample
S5: Calculate the concentration of reducing sugar in the sample using analytical methods

S6: Determine the concentration of proteins in the sample by quantitative analysis

ATTITUDE

A1: Appreciate the knowledge of Biochemistry in relating the significance of various enzymes in different pathological conditions.
A2: Follow professionalism in the working environment
A3: Participate in group discussions to plan effectively in performing experiments.
A4: Exhibit good communication skills to emerge as compassionate pharmacy professionals.
A5: Assist fellow students in executing the experiments.
A6: Demonstrate leadership quality in planning and executing experiments.
A7: Cooperate with other students within the team in laboratory practices.

COURSE CONTENTS

UNIT I **4 Hours**

Biomolecules

Introduction, classification, chemical nature (1hr)
Biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins(1hr).

Bioenergetics

Energy rich compounds; classification; (1hr)
Biological significances of ATP and cyclic AMP(1hr)
Concept of free energy, endergonic and exergonic reaction Relationship between free energy, enthalpy and entropy; Redox potential (1hr).

UNIT II **10 Hours**

Carbohydrate Metabolism

Glycolysis – Pathway, energetics and significance (1hr)
Citric acid cycle- Pathway, energetics and significance (1hr)
HMP shunt –Pathway and its significance; (1hr)
Glucose-6-Phosphate dehydrogenase (G6PD) deficiency (1hr)
Glycogen metabolism Pathways and glycogen storage diseases (GSD) (1hr)
Gluconeogenesis- Pathway and its significance, Hormonal regulation of blood glucose level and Diabetes mellitus(1hr)

Biological oxidation

Electron transport chain (ETC), mechanism. (1hr)
Oxidative phosphorylation & its mechanism(1hr)
substrate phosphorylation (1hr)
Inhibitors ETC and oxidative phosphorylation/Uncouplers(1hr)

UNIT III **6 Hours**

Lipid Metabolism

β-Oxidation of saturated fatty acid (Palmitic acid) (1hr)

Formation and utilization of ketone bodies; ketoacidosis (1hr)
De novo synthesis of fatty acids (Palmitic acid) (1hr)
Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D , Hypercholesterolemia, atherosclerosis, fatty liver, obesity. (1hr)

Amino acid metabolism

General reactions of amino acid metabolism: Transamination, deamination &decarboxylation, urea cycle (1hr)
Catabolism of phenylalanine, tyrosine 5-HT, melatonin, dopamine, noradrenaline, adrenaline, Catabolism of heme ,Disorders of urea cycle, Phenylketonuria, Albinism, alkeptonuria, tyrosinemia, hyperbilirubinemia and jaundice(1hr)

UNIT IV **4 Hours**

Nucleic Acid Metabolism and Genetic Information Transfer

Biosynthesis of purine and pyrimidine nucleotides (1hr)
Catabolism of purine nucleotides, Hyperuricemia, Gout(1hr)
Genetic code, (1hr)
Protein synthesis inhibitors(1hr)

UNIT V **6 Hours**

Enzymes

Introduction, properties, nomenclature and IUB classification of enzymes (1hr)
Enzyme kinetics -Michaelis plot, Line Weaver Burke plot (1hr)
Enzyme inhibitors with examples (1hr)
Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation (1hr)
Therapeutic and diagnostic applications of enzymes and isoenzymes (1hr)
Coenzymes –Structure and biochemical functions (1hr)

LIST OF EXPERIMENTS

1. Analyse the given sample of carbohydrate qualitatively. (Sample 1- Glucose)
2. Analyse the given sample of carbohydrate qualitatively. (Sample 2- Lactose)
3. Analyse the given sample of carbohydrate qualitatively. (Sample 3- Maltose)
4. Analyse the given sample of carbohydrate qualitatively. (Sample 4- Sucrose)
5. Analyse the given sample of carbohydrate qualitatively. (Sample 5- Fructose)
6. Identify the given sample of Amino acids (Sample 1- Histidine)
7. Identify the given sample of Amino acids (Sample 2- Tryptophan)
8. Identify the given sample of Amino acids (Sample 3-Arginine)
9. Identify the given sample of Amino acids (Sample 4-Methionine)
10. Identify the given sample of Amino acids (Sample 5- Tyrosine)
11. Detect the presence of abnormal constituents in urine (Sample 1: Albumin)
12. Detect the presence of abnormal constituents in urine (Sample 2: Bile salts)
13. Detect the presence of abnormal constituents in urine (Sample 3: Ketone bodies)
14. Detect the presence of abnormal constituents in urine (Sample 4: Glucose)
15. Test the presence of Proteins (Albumin, Casein)
16. Determine the concentration of reducing sugars by Benedict's Method
17. Determine the concentration of proteins by Biuret method

TEXT BOOKS:

1. Rodwell VW, Bender D A, Botham K M, Kennelly P J, Weil P A. Harper's Illustrated Biochemistry. 31st edn. McGraw Hill ; New York: 2022.
2. Satyanarayana U, Chakrapani U. Biochemistry. 6th edn. Elsevier; 2021
3. Pattabhiraman TN. Laboratory Manual & Practical Biochemistry, 4th edn. All India Publishers & Distributors India;2015. (Practical)

REFERENCE BOOKS:

1. Nelson DL, Cox MM. Lehninger Principles of Biochemistry. 8th edn. W. H. Freeman and Company; New York: 2021.
2. Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for Medical Students.9th edn. Jaypee Brothers Medical Publishers (P) Ltd; (Theory and Practical) New Delhi. 2019

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Engineering (T)	**2**	**0.5**	**0**	**30**	**2.5**	**II**	**BP204T**
Pharmaceutical Engineering (P)	**0**	**0**	**2**	**30**	**1**	**II**	**BP210P**

SCOPE: This course is designed to impart a fundamental knowledge on the art and science of various unit operations and unit processes employed in the pharmaceutical industry. It provides students with a comprehensive understanding of the essential techniques, design and considerations of unit operations such as size reduction, size separation, mixing, filtration, evaporation, distillation, drying etc., which are essential in pharmaceutical manufacturing. Students will learn about the different types of equipment and machinery used in pharmaceutical processes, their working principles, and the selection criteria for optimal performance.

The course discusses various preventive measures and control strategies to mitigate corrosion in pharmaceutical plants, including the use of protective coatings, cathodic protection, material selection, and proper maintenance practices. Demonstration sessions and laboratory experiments may be included to provide hands-on experience with unit operations, and the use of relevant equipment and instruments commonly employed in pharmaceutical engineering. It aims to prepare students for future roles in pharmaceutical manufacturing, quality control, and plant design and maintenance.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: List the various factors influencing unit operation.
K2: Identify the key parameters and variables that influence the performance of unit operations.
K3: Explain various unit operations used in pharmaceutical industry.
K4: Discuss the mechanism of a particular unit operation.
K5: Describe various material handling techniques used in pharmaceutical industry.
K6: Analyse various unit operations and their significance in pharmaceutical manufacturing.

SKILL

S1: Select appropriate materials for pharmaceutical plant construction.
S2: Apply engineering principles to optimize unit operations in the pharmaceutical industry.
S3: Develop standard operating procedures (SOPs) for unit operations and implement them effectively.
S4: Demonstrate an experiment to show the influence of process parameter in a particular unit operation process.
S5: Analyse pharmaceutical processes and unit operations based on specific requirements.
S6: Choose appropriate pharmaceutical equipment for carrying out desired unit operation process.

ATTITUDE

A1: Demonstrate a professional and ethical approach towards pharmaceutical engineering practices.

A2: Develop sharing and caring activity in the pharmaceutical engineering lab activities including safety aspects.

A3: Appreciate the impact of pharmaceutical engineering on the overall drug development and manufacturing process.

A4: Participate actively in the class room activities of pharmaceutical engineering subject.

A5: Display a commitment to continuous learning and keeping up-to-date with advancements in unit operations.

A6: Foster a sense of responsibility and accountability in the execution of unit operations in pharmaceutical engineering.

COURSE CONTENTS:

UNIT-I **9 Hours**

Introduction to Pharmaceutical Engineering, unit operations, unit processes and its pharmaceutical applications (1hr).

Size Reduction:

Objectives, Mechanisms & Laws governing size reduction(1hr).

Factors affecting size reduction(1hr).

Principles, construction, working, uses, merits and demerits of the following:

Hammer mill, ball mill, fluid energy mill(1hr)

Edge runner mill & end runner mill (1hr).

Size Separation:

Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation(1hr).

Principles, construction, working, uses, merits and demerits of the following:

Sieve shaker, cyclone separator (1hr)

Air separator, Bag filter & elutriation tank (1hr).

UNIT-II **7 Hours**

Evaporation:

Objectives, applications and factors influencing evaporation(1hr)

Differences between evaporation and other heat process(1hr).

principles, construction, working, uses, merits and demerits of :

Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator(1hr)

Forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator(1hr).

Distillation:

Basic Principles and methodology of the following:

Simple distillation, flash distillation(1hr)

fractional distillation, distillation under reduced pressure(1hr)

Steam distillation and molecular distillation (1hr).

UNIT- III **8 Hours**

Drying:

Objectives, applications & mechanism of drying process(1hr).

Measurements & applications of Equilibrium Moisture content, rate of drying curve(1hr).

Principles, construction, working, uses, merits and demerits of the following:

Tray dryer, drum dryer, spray dryer(1hr)

Fluidized bed dryer, vacuum dryer, freeze dryer(1hr).

Mixing:

Objectives, applications & factors affecting mixing(1hr).

Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing(1hr).

Principles, Construction, Working, uses, Merits and Demerits of the following:

Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer(1hr).

Planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier(1hr).

UNIT-IV **4 Hours**

Filtration:

Objectives, applications, Theories & Factors influencing filtration(1hr).

Filter aids, filter medias(1hr).

Principle, Construction, Working, Uses, Merits and demerits of the following:

Plate & frame filter, filter leaf, rotary drum filter(1hr).

Meta filter & Cartridge filter, membrane filters and Seidtz filter(1hr).

UNIT-V **2 Hours**

Materials of pharmaceutical plant construction, Corrosion and its prevention:

Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention(1hr).

Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handling systems(1hr).

LIST OF EXPERIMENTS

1. Steam distillation – To calculate the efficiency of steam distillation
2. To determine the overall heat transfer coefficient by heat exchanger.
3. Construction of drying curves (for calcium carbonate and starch).
4. Determination of moisture content and loss on drying, determination of instantaneous rate of drying for various samples.
5. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
6. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, probe sonicator, ultra-centrifuge, double cone blender.
7. Size analysis by sieving – To evaluate size distribution of tablet granulations.
8. Construction of various size frequency curves including arithmetic and logarithmic probability plots.

9. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
10. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity.

TEXT BOOKS:

1. C.V.S. Subrahmanyam. Pharmaceutical Engineering Unit Operations Principles and Practice.3rd edn, Vallabh Prakashan, Delhi, 2020.
2. O.P. Khanna. Industrial Engineering and Management.19th reprint edition, Jain Book Depot, Delhi. 2019.
3. S.J. Carter, Cooper and Gunn's- Tutorial Pharmacy. 6th edn, CBS Publishers New Delhi. 2000.
4. Dr. Bhushan R. Rane, sunil R. Bakliwal, Dr. Ashish S. Jain. A practical book of pharmaceutical engineering. 1st edn, Nirali Prakashan, Pune, 2018 (Practicals).

REFERENCE BOOKS:

1. W.L. Badger, J.Banchero. Introduction to the Chemical Engineering. 6th edn, Tata Mc Graw Hill, New Delhi, 2017.
2. W.L. Mcabe, J.C. Smith.Unit Operations of Chemical Engineering. 7th edn, Mc Graw Hill, New Delhi,2020.
3. K. Sambamurthy. Text book of Pharmaceutical Engineering. 2nd edn, New Age International (P) Ltd., Publishers, NewDelhi,2019.
4. Dr. Neelesh Chaubey, Md. Rageeb Md. Usman, Dr. Mohammed Zuber Shaikh, Prerna K. Mahajan, Keerthy H. S. A practical book of pharmaceutical engineering. 1st edn, Nirali Prakashan, Pune,2018.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Computer Applications In Pharmacy (T)	**2**	**0**	**0**	**30**	**2**	**II**	**BP205T**
Computer Applications In Pharmacy (P)	**0**	**0**	**2**	**30**	**1**	**II**	**BP211P**

SCOPE: This course deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases. Computers in pharmacy are used for the information of drug data, records and files, drug management (creating, modifying, adding and deleting data in patient files to generate reports), business details.

The field of pharmacy is fully benefitted by the use of computers getting and comparing the information to yield an accurate study. In retail pharmacy computers are used for printing out billing and payment information is often used for inventory control. Records of various drug data, i.e., drug data information; whenever drugs or medicaments are added to the stock or otherwise removed from the stock, the stock position is immediately updated.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course the student shall be able to;

KNOWLEDGE

K1: Define data base management system in computer.

K2: Illustrate the methods of data collection using search engines.

K3: Explain different types operations in Excel.

K4: Describe various applications of computers in pharmacy.

K5:Interpret the objective of bioinformatics and bioinformatics databases.

K6:Outline the role of computers as data analyst in preclinical development.

SKILL

S1: Analyze data using Excel .

S2: Construct tables of data using SQL.

S3: Differentiate various applications of computer in Pharmacy education

S4: Construct and modify databases in MS Access.

S5: Analyze drug information storage and retrieval using MS Access.

S6: Construct different labels and dashboard using Excel.

ATTITUDE

A1: Support other students for mutual improvements.

A2: Participate actively in the practical sessions and class room activities.

A3: Foster a sense of responsibility and professionalism while working in lab

A4: Be sincere and punctual.

A5: Accept all the merits and demerits of computer application in Pharmacy.

A6: Detect various use of cloud computing in hospital and clinical pharmacy.

COURSE CONTENTS:

UNIT I **10 Hours**

Programming languages and basic soft wares

Programming Languages – C/C++, Java, Python (more focus on Python) (2hrs)

Database – Database, Database Management System, SQL, Popular DMBS like MySQL, Mongo DB (2hrs)

Introduction to Search engines, methods of data collection (2hrs)

Cloud Computing – Basics (1hr)

Analytics – Excel, Basic Operations, Excel Formulas & Functions, Data analysis and its representation, creating custom Dashboards using Excel (2hrs)

Emergence of Python as an important language for AI/ML, Data Science & Data Analytics (1hr)

UNIT II **6 Hours**

Computers in purchasing and inventory control of retail and wholesale pharmacy shops

Computer software for billing process, drug information, preparation of prescription label, record of transactions, automatic ordering of low quantity products via electronic transitions (2hrs)

generation of multiple sales analysis for a day, month, weak and to date for the number of prescriptions handled and amounts in cash. position of the stock, annual auditing, tracking the movements of stock. (2hrs)

international data banks are available such as World standard drug database, Drug bank, MEDLARS (Medical Literature Analysis and Retrieval System) and DIALOG. (2hrs)

UNIT III **5 Hours**

Computers in hospital and clinical pharmacy

Computer software for receiving and allotment of drugs and medicines and professional supplies, Maintaining patient medical record, Drug information services, Patient monitoring(2hrs)

Computer programs designed to calculate drug dosage to suit individual patients need. Laboratory Information Management System(LIMS) and Text Information Management System(TIMS), hospital management system (HMS) (3 hrs)

UNIT IV **3 Hours**

Computers in pharmacy education

Use of multimedia packages, hypertext video chats, web based education, multimedia based education (1hr)

Intelligent tutoring system, digital libraries, simulation laboratories, tele-education

Computer Aided Learning (CAL) (2hrs)

UNIT V **3 Hours**

Computers in drug analysis and drug design

Software associated with various analytical instruments, In built libraries associated with software for searching of data (2 hrs)

Drug design assisted by computer software, Bioinformatics and cheminformatics software. (1hr)

UNIT VI **3 Hours**

Computers in management of clinical data

Computer software used in clinical trials data collection and management(1hr)

Registration, study management tools, and statistical analysis, E-clinical soft wares (2hrs)

LIST OF EXPERIMENTS

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML webpage to show personal information.
3. Retrieve the information of a drug and its adverse effects using online tools
4. Creating mailing labels Using Label Wizard, generating label in MS WORD
5. Create a data base in MS Access to store the patient information with the required fields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables , Queries ,Forms and Reports to webpages
12. Exporting Tables, Queries , Form sand Reports to XML pages

TEXT BOOK

1. Sean Ekins , Wiley Computer Application in Pharmaceutical Research and Development, Inter- science, A John Willey and Sons, INC., Publication, USA.2019
2. S.C.Rastogi ,Bioinformatics (Concept, Skills and Applications) , 2nd Edition, CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA).2006

REFERENCE BOOKS:

1. Cary N.Prague ,Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath, Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi –110002. 2004

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Glimpses of Glorious India-Theory	**2**	**0**	**0**	**30**	**2**	**II**	**22ADM111**

SCOPE: To introduce students to the depths and richness of the Indian culture and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

COURSE LEARNING OUTCOMES:

CO1 This part deals with two topics: The Need to Become Fearless in Life and the Role or Status of Women in India.

CO2 This part deals with three topics: Teachings and Principles of Chanakya, Difference between the terms *God and Iswara* and Contribution of *Bhagavad Gita.*

CO3 This area handles two important concepts: Indian Soft powers and A portrayal of how nature was preserved through the medium of Faith.

CO4 Two important topics are discussed here: A Brief history of Ancient Indian Cultures and a Discussion on Practical Vedanta.

CO5 From this part, a student gets an insight into the contribution that India has made to the world. Moreover, foreign powers have been trying to humiliate and degrade India in front of the world for so long. However, it should be recognized that many inventions that are considered beneficial to the world today have been contributed by the great men of India.

COURSE CONTENTS:

UNIT 1 - Face the Brutes
UNIT 2 - Role of Women in India
UNIT 3 - Acharya Chanakya
UNIT 4 - God and Iswara
UNIT 5 - Bhagavad Gita: From Soldier to Samsarin to Sadhaka
UNIT 6 - Lessons of Yoga from Bhagavad Gita
UNIT 7 - Indian Soft Powers: A Solution For Many Global Challenges
UNIT 8 - Nature Preservation through faith
UNIT 9 - Ancient Cultures what happened to them.
UNIT 10 - Practical Vedanta
UNIT 11 - To the World from India
UNIT 12 - Indian Approach to Science

TEXTBOOK:
Glimpses of Glorious India

REFERENCE COURSE MATERIAL
Topic wise PPTs will be uploaded in Teams

SEMESTER-III

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Organic Chemistry –II(T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP301T**
Pharmaceutical Organic Chemistry –II (P)	**0**	**0**	**2**	**30**	**1**	**III**	**BP309P**

SCOPE: This subject deals with general methods of preparation, reactions and mechanisms of some important organic compounds. The subject covers the structural elucidation of benzene and its reaction. The substituents effect of benzene towards electrophilic substitution reactions was also discussed. The chemical reactivity of phenol, aromatic amines and aromatic carboxylic acid and its significance in the organic chemistry is described.

The syllabus emphasizes the synthesis and reactions of polynuclear hydrocarbons. The subject also deals with the stability of cycloalkanes. Introduction of heterocyclic chemistry, classification of heterocyclic compounds, IUPAC rules, synthesis and reactions of five membered heterocyclic compounds are included in the syllabus.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Describe the basic principles of organic chemical reactions and their mechanism (Remembering).
K2: Explain the evidence of elucidating various organic function groups by qualitative analysis (Comprehension).
K3: Apply the synthetic applications of substituted benzene, phenol, aromatic carboxylic acid, aromatic primary amine, and polynuclear hydrocarbons (Application).
K4: Determine the stability of cycloalkanes (Analysis).
K5: Categorize the different classes of heterocyclic compounds and summarize the electrophilic substitution reactions of five-membered heterocyclic compounds (Synthesis).
K6: Choose the structure and commercial uses of some organic compounds (Evaluation).

SKILLS

S1: Demonstrate the effects of substituents on the acidity and basicity of aromatic carboxylic acid and phenol.
S2: Design various classes of mono-substituted benzenes from the diazonium salts.
S3: Detect the orientation of electrophilic substitution reactions of monosubstituted benzene and polynuclear hydrocarbons.
S4: Calibrate Huckle's rule.
S5: Measure the yield of the synthesised organic compounds.
S6: Estimate the purity of the synthesised organic compounds.

ATTITUDES

A1: Accept the responsibility and work as a team.
A2: Participate actively in the discussion.
A3: Follow good laboratory practices.
A4: Cooperate with students and others.
A5: Develop sharing and caring.
A6: Praise the capacity of self evaluation and motivate for lifelong learning.

COURSE CONTENTS:

General methods of preparation and reactions of compounds superscripted with an asterisk (*) to be explained. To emphasize definition, types, classification, principles/mechanisms, applications, and examples.

UNIT I 7 Hours

Benzene and Its Derivatives

Analytical, synthetic and evidence in the derivation of the structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule.(2 hrs)
Reactions of benzene - nitration, sulphonation, halogenations reactivity, Friedel-crafts alkylation-reactivity, limitations, Friedel-crafts acylation. (2hrs)
Substituents, the effect of substituents on reactivity and orientation of monosubstituted benzene compounds towards electrophilic substitution reaction.(2hrs)
Structure and uses of DDT, Saccharin, BHC and Chloramine. (1hr)

UNIT II 7 Hours

Phenols* - Acidity of phenols, the effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols.(3 hrs)
Aromatic Amines - Basicity of amines, the effect of substituents on basicity, and synthetic uses of aryl diazonium salts (2 hrs)
Aromatic Acids* –Acidity, the effect of substituents on acidity and important reactions of benzoic acid. (2hrs)

UNIT III 5 Hours

Polynuclear Hydrocarbons

Synthesis and reactions, of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.

UNIT IV 4 Hours

Cycloalkanes

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane.

UNIT V **7 Hours**

Heterocyclic compounds: Nomenclature and classification. (2 hrs)
Synthesis, reactions and medicinal uses of the following compounds/ derivatives Pyrrole, Furan, and Thiophene. . (3 hrs)
Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene. . (2 hrs)

LIST OF EXPERIMENTS:

1. Preparation of 1-Phenylazo-2-naphthol
2. Preparation of meta-dinitrobenzene
3. Preparation of dibenzalacetone
4. Preparation of phenyl benzoate
5. Preparation of benzil
6. Preparation of salicylic acid
7. Preparation of hydrazones by monowave-assisted synthesis
8. Demonstration of recrystallisation

TEXT BOOKS:

1. Morrison, R. T., & Boyd, R. N and Bhattacharjee. Organic chemistry. 7th ed. Pearson Education India; 2010.
2. I.L. Finar. Organic Chemistry. 6th ed. Pearson Education India; 2002.
3. Arun Bahl and B.S. Bahl. A textbook of organic chemistry. 22nd ed. S. Chand; 2016.

REFERENCE BOOKS:

1. Mann F.G & Saunders B C. Practical organic chemistry. 4th edn. Pearson Education India; 2009
2. BruiceP. Y.Organic Chemistry. 8thedn.Upper Saddle River, NJ: Pearson Education; 2015.
3. Brian S. F, Antony J.H, Peter W.G.S & Austin R.T. Vogel's textbook of Practical Organic Chemistry. 5th edn. Pearson Education India; 2003.
4. Indian Pharmacopoeia, Vol 1, 2014.
5. Bansal R.K, Heterocyclic chemistry. 6th edn. New age international private limited India; 2019.
6. Gilchrist L.T. Heterocyclic chemistry. 3rdedn. Pearson publishers; India: 1997.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Physical Pharmaceutics-I (T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP302T**
Physical Pharmaceutics-I (P)	**0**	**0**	**2**	**30**	**1**	**III**	**BP310P**

SCOPE: The course deals with the various physical properties of drugs and excipients essential for formulation development. It discusses fundamental properties of drugs like solubility and partition, which helps to correlate drug disposition in biological systems. Different other properties of drug and excipients like polymorphism, optical rotation, dissociation constant etc gives a strong tool for their identification.

Diverse use of surfactants, complexes and buffers develop a strong base for formulation development, problem analysis and resolution. In the laboratory students perform basic experiments like solubility, partition coefficient, surface tension determination and analyse adsorption capacity and complexation of different samples. Students encouraged to perform by themselves, participate in group discussions during class hrs and follow good laboratory practices. This aids in the development of students' self-confidence, teamwork, and professionalism.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, student shall be able to

KNOWLEDGE

K1: Discuss the mechanism and significance of solubility of drugs. (Understand)
K2: Explain various solid state properties of drug molecules in designing the dosage forms (Understand)
K3: Describe various methods for determination of surface & interfacial tension(Understand)
K4: Classify type of complexes. (Comprehension)
K5: Criticize the effect of protein binding on drug action. **(**Evaluate**)**
K6: Differentiate the effects of factors on solubility of gas, liquids and solids in liquids (comprehension)

SKILL

S1: Design suitable buffer and isotonic media for pharmaceuticals.
S2: Measure the HLB value of surfactant
S3: Demonstrate the change in properties of drugs after complexation.
S4: Comment on the nature of acid/base based on its pKa value.
S5: Estimate the adsorption capacity of adsorbents.
S6: Assess the solubility of drugs in different solvents.

ATTITUDE

A1: Maintain laboratory/classroom decorum.
A2: Keep your attention in class.
A3: Follow Good Laboratory Practice guideline.
A4: Take an active role in class discussion.
A5: Stay away from distractions.
A6: Show compassion for our fellow beings.

COURSE CONTENTS:

UNIT I **7 Hours**

Solubility of drugs:
Solubility expressions, mechanisms of solute solvent interactions, (1hr)
Ideal solubility parameters, Solvation & Association (1hr),
Quantitative approach to the factors influencing solubility of drugs, Diffusion principles in biological systems (2hrs).
Solubility of gas in liquids, Solubility of liquids in liquids, Binary solutions, Ideal solutions (1hr).
Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature (1hr) and applications.
Distribution law, its limitations and applications (1hr)

UNIT II **9 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, Latent heats, Vapour pressure, (1hr)
Sublimation critical Point, Eutectic mixtures, Gases, Aerosols– inhalers (1hr)
Relative humidity, Liquid complexes (1hr)
Liquid crystals, Glassy states(1hr)
Solid crystalline, Amorphous & polymorphism(1hr).
Physicochemical properties of drug molecules: Refractive index(1hr)
Optical rotation(1hr)
Dielectric constant, Dipole moment(1hr)
Dissociation constant, Determinations and applications(1hr)

UNIT III **5 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions (1hr), Surface free energy, Measurement of surface & interfacial tensions (1hr),
Spreading coefficient(1hr),
Adsorption at liquid interfaces, Surface active agents, HLB Scale, (1hr)
Solubilisation, Wettability, Detergency, Adsorption at solid interface. (1hr)

UNIT IV **5 Hours**

Complexation and protein binding: Introduction, Classification of complexation(1hr), Applications, methods of analysis(2hrs),

Protein binding, Complexation and drug action,(1hr)
Crystalline structures of complexes and thermodynamic treatment of stability constants. (1hr)

UNIT V **4 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), (1hr)
Applications of buffers, Buffer equation, Buffer capacity,(1hr) Buffers in pharmaceutical and Biological systems, Buffered isotonic solutions and calculations(2hrs)

LIST OF EXPERIMENTS:

1. Assess of the solubility of drug at room temperature in different solvents.
2. Describe the nature of acid/base based on pKa value obtained by Half Neutralization/ Henderson Hasselbalch equation.
3. Comment on the nature of drug (oxalic acid) based on partition co-efficient value in octanol and water system.
4. Remarks on the nature of the drug (benzoic acid) based on the partition co-efficient value in the benzene and water system.
5. Determination of % composition of NaCl in a solution using the phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weightMethod
7. Analyze the nature of the surfactant based on the HLB number driven by the saponification method.
8. Summarize the adsorption capacity of charcoal by Freundlich and Langmuir adsorption isotherms.
9. Assess critical micellar concentration of surfactants
10. Determination of stability constant and donor-acceptor ratio of PABA-Caffeine
11. complex by solubility method
12. Calculate the stability constant and donor-acceptor ratio of Cupric-Glycine
13. complex by pH titration method

TEXT BOOKS:

1. Martin A, Bustamante P, Chun AHC. Physical Pharmacy, Physical Chemical Principles in Pharmaceutical sciences. 4th edn, Lippincott Williams and Wilkins, Philadelphia, 2001.
2. Sateesha SB & Rajamma AJ. Physical Pharmaceutics Principles of Formulation: Buy Physical Pharmaceutics Principles of Formulation, EMMESS Medical publishers, Bangalore, first edition, 2020.
3. Subrahmanium CVS. Physical Pharmaceutics. 2nd edn, Vallabh Prakashan, Delhi, 2000.

REFERENCES BOOKS:

1. Remington: The Science and Practice of Pharmacy. 23rd edn, Elsevier, 2020.
2. Subramanyam CVS, Settee JT. Laboratory Manual of Physical Pharmaceutics. Vallabh Publication 2014.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Microbiology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP303T**
Pharmaceutical Microbiology (P)	**0**	**0**	**2**	**30**	**1**	**III**	**BP311P**

SCOPE: This course deals with the fundamental aspects of microorganisms that are relevant to the field of pharmaceutical sciences, including their classification, morphology, laboratory cultivation, identification and maintenance. The course includes an in-depth examination of sterilization techniques and the different methods used to control and eliminate microbial contamination in pharmaceutical manufacturing processes. Students will learn about different types of disinfectants, their modes of action, and their application in maintaining aseptic conditions in pharmaceutical facilities. Microbiological assay techniques used for the estimation of antibiotics, vitamins, and other pharmaceutical substances will be covered in detail.

The course also focuses on the principles and practices of aseptic area design and maintenance, which are essential for ensuring the sterility of pharmaceutical products. Students will gain knowledge about the principles of microbial control in pharmaceutical environments, including cleanrooms, air handling, and water systems. The study of microbial spoilage and preservation methods for pharmaceutical products is included, helping students understand the factors that can lead to product deterioration and the strategies to prevent it.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Explain the methods of cultivation and preservation of microorganisms.
K2: Describe the various microbiological assays & microbiological standardization for pharmaceuticals.
K3: Identify different types of microorganisms relevant to pharmaceutical sciences.
K4: Analyse the principles and applications of microbial quality control in pharmaceutical manufacturing.
K5: Demonstrate different types of staining techniques in identifying microbes.
K6: Design appropriate sterilization and disinfection protocols for pharmaceutical manufacturing processes.

SKILLS

S1: Identify microorganisms relevant to pharmaceutical microbiology, such as bacteria, fungi, and viruses.
S2: Apply aseptic techniques and laboratory protocols effectively in handling microorganisms.

S3: Perform microbial isolation, identification, and characterization techniques in the pharmaceutical microbiology laboratory.
S4: Acquire hands-on skills in performing microbiological tests, including microbial enumeration, and antimicrobial susceptibility testing.
S5: Design experiments to evaluate the antimicrobial efficacy of pharmaceutical agents.
S6: Select appropriate techniques for microbial control and sterilization in pharmaceutical settings.

ATTITUDES

A1: Appreciate the importance of maintaining a clean and hygienic work area to prevent microbial contamination.
A2: Demonstrate ethical conduct in the use of microorganisms and adherence to safety guidelines.
A3: Cultivate a scientific curiosity and a desire for continuous learning.
A4: Display patience and attention to detail while working.
A5: Exhibit an understanding of the impact of microbial contamination on the safety and efficacy of pharmaceutical products.
A6: Foster a sense of responsibility and professionalism while working in a laboratory environment.

COURSE CONTENTS:

UNIT I **9 Hours**

Basics of microbiology:
Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes (1hr).
Study of different types of phase contrast microscopy and dark field Microscopy (1hr).
Bacteria:
Study of ultra-structure and morphological classification of bacteria(1hr)
Nutritional requirements(1hr)
Raw materials used for culture media and physical parameters for its growth(1hr)
Bacterial growth curve, isolation, and preservation methods for pure cultures(1hr)
Cultivation of aerobes & anaerobes(1hr)
Quantitative measurement of bacterial growth -total & viable count(1hr)
Identification of bacteria using staining techniques (simple, Gram's & acid fast staining) and biochemical tests (IMViC) (1hr).

UNIT II **8 Hours**

Fungi & viruses:
Study of morphology(1hr)
Classification (1hr)
Reproduction/replication(1hr)
Pharmaceutical application(1hr)
Cultivation of Fungi and Viruses with suitable examples(1hr).
Corona viruses in Humans - COVID-19; Structural details(1hr),
Pathophysiology(1hr),
Clinical findings & its mode of treatment(1hr).

UNIT III **5 Hours**

Sterilization:

Study of principle, procedure, merits, demerits and applications of:
Physical, chemical, gaseous(1hr),
Radiation and mechanical method of sterilization(1hr).
Evaluation of the efficiency of sterilization methods(1hr).
Sterility indicators(1hr).
Sterility testing of products including solids, liquids, ophthalmic and other sterile products, according to IP, BP and USP(1hr).

UNIT IV **3 Hours**

Disinfectants:

Classification and mode of action of disinfectants(1hr),
Factors influencing disinfection, antiseptics and their evaluation(1hr).
Evaluation of disinfectants, bactericides & Bacteriostatics(1hr).

UNIT V **5 Hours**

Aseptic area and microbial control:

Designing of aseptic area, laminar flow equipments(1hr),
Study of different sources of contamination in an aseptic area and methods of prevention, clean area classification(1hr).

Microbiological assays:

Principles and methods of different microbiological assay, Assessment of a new antibiotic (1hr).
Methods for standardization of antibiotics and vitamins(1hr).

Microbial Spoilage:

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage(1hr).

LIST OF EXPERIMENTS:

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator,
2. laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator,
3. microscopes used in experimental microbiology.
4. Sterilization of glassware, preparation and sterilization of culture media for bacteria and fungi.
5. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
6. Aseptic transfer of sterile nutrient agar into the sterile culture tube / sterile perti plate.
7. Aseptic transfer of micro-organisms into the sterile agar slant/ sterile nutrient agar plate.
8. Staining methods- Simple, Grams staining and acid fast staining
9. Isolation of pure culture of micro-organisms by simple streaking, multiple streak plate technique and other techniques.
10. Total viable count of bacteria in soil culture by pour plate and spread plate method
11. Motility determination of bacteria by Hanging drop method.
12. Biochemical test of Bacteria.
13. Sterility testing of pharmaceuticals.
14. Antibiotic sensitivity test using various antibiotics by cup plate method.

TEXT BOOKS:

1. Ananthanarayan and Panicker's. Text book of Microbiology. 12th edn, Orient Longman Ltd, Chennai, 2022.
2. Chandrakant R. K. Pharmaceutical Microbiology. 9th edn, Nirali Prakashan, Pune, 2022.
3. Pelczar, Chan Kreig.Microbiology.5th edn,Tata McGraw Hill edition, NewDelhi, 2019.

REFERENCE BOOKS:

1. Prescot L.M, Jarley G.P, Klein D.A. Microbiology.2nd edn, Mc Graw Hill Company Inc., 2005.
2. .Hugo W.B, Russel. Pharmaceutical Microbiology.8th edn. Blackwell Scientific Publications, London. 2018.
3. Seth A.K. Pharmaceutical Microbiology (A Laboratory Hand Book).1st edn, S. Vikas & Co. Publishing House, Jalandhar, 2018 (Practicals).
4. Ashutoshkar. Pharmaceutical Microbiology. 1st edn, New Age International Ltd Publishers, New Delhi, 2019.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pathophysiology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP304T**

SCOPE: This course is designed to impart a basic knowledge of the physiological changes and mechanisms underlying disease processes. It focuses on understanding how normal physiological functions are disrupted or altered in various disease states. It emphasizes the mechanisms and processes involved in the development, progression, and outcomes of different diseases. It covers a wide range of diseases, including infectious diseases, genetic disorders, autoimmune diseases, metabolic disorders, cardiovascular diseases, neurological disorders.

This also explores the causative factors and risk factors that contribute to the development of diseases. It investigates the role of genetics, environmental factors, lifestyle choices, infections, and other triggers in disease initiation and progression. It also addresses how disease processes can lead to altered vital signs, organ dysfunction, pain, and other clinical presentations.

COURSE LEARNING OUTCOMES:

Upon successful completion of the subject student shall be able to

KNOWLEDGE

K1 : Define the basic terminology related to pathophysiology

K2 Explain the basic nature of disease processes in terms of etiology, epidemiology, natural history, and structural and functional abnormalities in the body systems

K3 : Discuss the pathophysiologic mechanisms responsible for diseases of major public health importance

K4 : Classify diseases of various body systems and how they manifest clinically

K5 : Describe Basic principles of Cell Injury Adaptation and explain the concept of inflammation and repair

K6 : Enumerate the morphologic (gross & microscopic) changes occurring as a result of different injuries in various orga

SKILLS:

S1 : Differentiate between normal and abnormal inflammatory responses.

S2 : Identify factors that may impair the wound healing process, such as underlying diseases, medications, and lifestyle factors.

S3 : Propose various disorders based on their underlying pathophysiological mechanisms.

S4 : Differentiate between structural and functional abnormalities of cns, cvs, respiratory, urinary, skeletal and reproductive system.

S5 : Relate specific pathophysiological alterations to the clinical manifestations observed in patients

S6 : Recognize the signs and symptoms of infectious diseases and correlate them with diagnostic test results for accurate diagnosis.

ATTITUDE:

A1: Appreciate and respect the diversity of patients' cultural backgrounds, beliefs, and values in the context of pathophysiological conditions.

A2 : Educate patients about their disorders, including its pathophysiology, risk factors, and management strategies.

A3: Recognize the emotional and psychological aspects of illness and demonstrating sensitivity in interactions with patients, families, and caregivers

A4: Provide lifestyle recommendations, such as diet modification, exercise, and stress management, to optimize overall health

A5: Communicate and educate others on infection control practices to prevent the spread of infectious diseases

A6: Participate in various programmers related to education on safe sex practices, risk reduction strategies, and the importance of regular STD screenings

COURSE CONTENTS:

UNIT I **6 Hours**

Basic principles of Cell injury and Adaptation:

Introduction:(1 hr)

Homeostasis, Components, and Types of Feedback systems,

Cell injury: (1 hr)

Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage),Morphology of cell injury (2 hrs)

Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death (necrosis and apoptosis) Acidosis & Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair

Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's.Basic principles of wound healing in the skin: Classification of wounds Stages of wound healing, Mechanism of tissue repair, factors affecting wound healing(2 hrs)

UNIT II **6 Hours**

Cardiovascular System:

Hypertension, Congestive heart failure, Ischemic heart disease (angina, atherosclerosis) (3 hrs)

Respiratory system

Asthma, Chronic obstructive airway diseases and Emphysema (2 hrs)

Renal system

Acute and chronic renal failure (1 hr)

UNIT III **9 Hours**

Hematological diseases

Anaemia: Iron deficiency anaemia, Megaloblastic anaemia (vitamin B12 and folic acid) Sickle cell anaemia (2 hrs)

Endocrine system

Diabetes, Thyroid disorders, Disorders of sex hormones: Menstrual function and fertility disorders, Polycystic ovary syndrome (PCOS), Hypogonadism and gynecomastia (3 hrs)

Nervous system:

Epilepsy, Stroke (ischemic and haemorrhagic stroke), Parkinsonism (2 hrs)

Psychiatric disorders:

Depression, Schizophrenia and Alzheimer's disease (2 hrs)

UNIT IV **6 Hours**

Diseases of bones and joints:

Rheumatoid arthritis and Gouty arthritis , Osteoporosis (2 hrs)

Gastrointestinal system:

Peptic ulcer, Hepatitis (A, B, C, D, E), Liver cirrhosis and alcoholic liver diseases(2 hrs)

Cancer: Etiologic factors related to the development of cancer

Molecular basis for cancer development and progression

Benign and malignant tumours, Tumour Invasion and metastasis (2 hrs)

UNIT V **3 Hours**

Infectious diseases:

Malaria, Tuberculosis, Leprosy (2 hrs)

Sexually transmitted disease:

AIDS (1 hr)

TEXT BOOKS:

1. Vinay Kumar, Abul Abbas, Jon C. Aster. Robbins & Cotran Pathologic Basis of Disease, 10th edn: South Asia Edition, Elsevier India; 2020
2. Harsh Mohan; Textbook of Pathology; 8th edn; Jaypee Brothers Medical Publishers (P) Ltd. India; 2022
3. Hall, John, E. *Guyton and Hall Textbook of Medical Physiology*. 14th ed. Philadelphia: Elsevier 2020

REFERENCE BOOKS:

1. David E. Golan, Ehrin J. Armstrong, April W. Armstrong. Principles of pharmacology: The pathophysiologic basis of drug therapy: 4th edn, Wolters Kluwer India; 2016
2. Gary D. Hammer, Stephen J. McPhee. Pathophysiology of Disease: An Introduction to Clinical Medicine, 8th edn McGraw-Hill Education, New York; 2019
3. Kathryn L, McCance & Sue E Huether, Pathophysiology: The Biologic Basis for Disease in Adults and Children, 8th edn, Elsevier Health Sciences; 2018.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacognosy And Phytochemistry I (T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP305T**
Pharmacognosy And Phytochemistry I (P)	**0**	**0**	**2**	**30**	**1**	**III**	**BP312P**

SCOPE: This course is designed to impart fundamentals of Pharmacognosy and provides students with a comprehensive understanding of sources of drugs such as plants, animals, marine & tissue culture; classification of crude drugs based on morphological, taxonomical, chemical, pharmacological attributes. It also introduces history, scope and development of pharmacognosy.

The course deals with different aspects of cultivation, collection, processing and storage of crude drugs of natural origin. Also, it offers basic knowledge on plant tissue culture and its application in the production of phytopharmaceuticals. Furthermore, the course covers the study of the chemistry, sources, preparation, evaluation, preservation, storage, therapeutic/commercial utility of drugs derived from natural products. The scope of the course is to equip the students with the necessary knowledge and skills to detect adulteration of crude drug and different methods for their evaluation. The students encouraged to develop leadership qualities and teamwork.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Explain the history, scope and development of Pharmacognosy.
K2: Discuss the application of drugs from natural origin and their chemical nature and uses.
K3: Describe the techniques for cultivation, collection and evaluation of crude drugs.
K4: Discuss fundamental aspects of plant tissue culture.
K5: Classify the crude drugs from natural origin.
K6: Enumerate the factors influencing cultivation of medicinal plants.

SKILL

S1: Analyze the crude drugs by microscopic methods.
S2: Identify the crude drugs by physical methods.
S3: Evaluate the crude drugs by chemical methods.
S4: Determine the purity of crude drugs by quantitative microscopic methods.
S5: Analyze the leaf drugs bydetermining the leaf constants.
S6: Distinguish the different crude drugs based on their organoleptic characters

ATTITUDE

A1: Enhance their self-awareness and personal growth.
A2: Learn to cope with challenges, setbacks, and changes.
A3: Embrace a lifelong learning mindset.
A4: Developleadership qualities and skills.
A5: Cultivate communication and collaboration skills.
A6: Improve critical thinking skills.

COURSE CONTENTS

UNIT I **12 Hours**

Introduction to Pharmacognosy:

Definition, history scope and development of Pharmacognosy (1 hr)
Sources of Drugs – Plants, Animals, Marine & Tissue culture (2 hrs)

Classification of drugs:

Alphabetical, morphological, taxonomical, Chemical, Pharmacological, Chemo and sero taxonomical classification of drugs (2 hrs)
Organized drugs, Unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, Oleoresins and oleo- gum -resins). (1 hr)

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. (2 hrs)

Different methods for evaluation of crude drugs

Organoleptic/Morphologicalmethods(1 hr)
Microscopicmethods : (1 hr)
Quantitative microscopy
Lycopodium spore method
Leaf measurements
Physical, Chemical Biological methods (2 hrs)

UNIT II **8 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin (2 hrs)
Processing and storage of drugs of natural origin (1 hr)
Factors influencing cultivation of medicinal plants. (2 hrs)
Plant hormones and their applications. (1 hr)
Polyploidy, mutation and hybridization with reference to medicinal plants (1 hr)
Conservation of medicinal plants (1 hr)

UNIT III **5 Hours**

Plant tissue culture:

Historical development of plant tissue culture
Types of cultures. (1 hr)
Nutritional requirements (1 hr)

Growth and their maintenance (1 hr)
Applications of plant tissue culture in pharmacognosy (1 hr)
Edible vaccines (1 hr)

UNIT IV **5 Hours**

Primary metabolites:

General introduction, detailed study with respect to chemistry, Sources, Preparation, Evaluation, Preservation, Storage, Therapeutic used and commercial utility as pharmaceutical aids and/or Medicines for the following Primarymetabolites:

Carbohydrates: Acacia, Agar, Honey, Tragacanth, Isapgol(1 hr)

Proteins and Proteolytic enzymes: casein, gelatin, Papain, Bromelain, Pepsin Serratiopeptidase, Urokinase, Streptokinase (1 hr)

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Bees Wax, Wool Fat (1 hr)

Study of biological source, Chemical nature and uses of drugs of natural origin containing following drugs: (1 hr)

Fibers – Cotton, Jute, Hemp
Hallucinogens
Teratogens
Natural allergens

Marine Drugs: Novel medicinal agents from marine sources (1 hr)

LIST OF EXPERIMENTS:

1. Analysis of crude drugs by chemical tests:
   (i)Tragacanth (ii) Acacia (iii)Agar (iv)Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece Micrometer.
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determine and compare the following parameter of the crude drugs:
   - Extractive values
   - Moisture content
   - Swelling index
   - Foaming index

TEXT BOOKS:

1. EvansWC. Trease and Evans Pharmacognosy. 16th edn. W.B. Sounders & Co. London; 2009.
2. Kokate CK, Purohit AP, Gokhlae SB. Text book of Pharmacognosy.37th edn.: NiraliPrakashan; New Delhi 2007.
3. RangariVD.Pharmacognosy and Phytochemistry.Vol. I & II, 3rd edn. Career Publications; Nashik: 2017.

REFERENCE BOOKS:

1. Wallis TE.Text Book of Pharmacognosy.5th edn. CBS Publishers &Distribution; New Delhi: 2005.
2. AnsariSH. Essentials of Pharmacognosy. 2nd edn. Birla publications, New Delhi: 2007.
3. Ali M. Pharmacognosy and Phytochemistry. Vol. I & II, 1st edn. CBS Publishers & Distribution; New Delhi: 2009.
4. Kokate CK, Purohit AP, Gokhlae SB. Practical Pharmacognosy. 13th edn. NiraliPrakashan; New Delhi: 2009. (Practicals)

ADDITIONAL READING MATERIALS:

1. Quality control methods for herbal materials. World Health Organization; 2002.
2. Ansari SH. Essentials of Pharmacognosy. 2nd edn. Birla publications; New Delhi: 2007.
3. Mukherjee PK. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. 1st edn. Business Horizons Publishers; New Delhi: 2002.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Social And Preventive Pharmacy (T)	**2**	**0.5**	**0**	**30**	**2.5**	**III**	**BP306T**

SCOPE: This course is designed to impart basic knowledge about various disease conditions and its management and give an idea about various national health programmes initiated by Government of India. It encompasses various theoretical concepts and principles related to the social, behavioural, and preventive aspects of pharmacy practice. Social and Preventive Pharmacy explores the principles of public health and its application to pharmacy practice. It involves studying epidemiology, health promotion, disease prevention, and health education.

Prevention plans for nutritional deficiencies involve strategies aimed at ensuring individuals and communities to a balanced and adequate diet that meets their nutritional needs. These learning outcomes aim to equip students with a comprehensive understanding of the general principles for disease control, enabling them to contribute to public health and there by prevention and management of various diseases. The course also teaches skills necessary to contribute effectively to the functioning of a Primary Health Centre, promoting primary healthcare principles and addressing the healthcare needs of the community. It enables them to contribute effectively to the implementation, delivery, and monitoring of national health programs, ultimately improving healthcare access, quality, and positive outcomes for individuals and communities. The course also promotes health education in school. Overall, the scope of this course is to equip pharmacy students with the knowledge and skills necessary to contribute to public health initiatives, engage in health promotion, and prevent diseases through the application of pharmaceutical care principles and public health strategies.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Describe prevention plan for nutritional deficiencies
K2: Explain the general principles for the control of various diseases
K3: Outline the objectives and goals of various National Health Programs
K4: Discuss the various program initiated by Government of India for promotion of health.
K5: List the functions of primary health center
K6*:* Identify types of biomedical waste and principle of its segregation.

SKILL

S1: Apply the various responsibilities of Pharmacist in primary health center
S2: Review the importance of personal hygiene and health
S3: Evaluate the importance of universal immunization program

S4: Interpret the sociocultural factors related to health and disease
S5: Examine the impact of national health program in India
S6: Justify the general principles used in preventive medicine

ATTITUDE

A1: Participate in various National healthcare program
A2: Practice the habit of personal hygiene and health care
A3: Assist the health education
A4: Appreciate the HIV and AIDS control Program in India and global
A5: Examine the national health intervention program for mother and child
A6: Plan for community health services in rural area

COURSE CONTENTS:

UNIT I **5 Hours**

Determinants and indicators of Health

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. (1hr)

Vitamins: Classification, sources, biological importance and deficiency disorders. (1hr)

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health (1hr)

Hygiene and health: personal hygiene and health care; avoidable habits (1hr)

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Malnutrition and its prevention (1hr)

UNIT II **13 Hours**

Preventive medicine

General principles of prevention and control of diseases such as cholera (1hr)
SARS, Ebola virus (1hr)
Influenza (1hr)
Acute respiratory infections(1hr)
Malaria (1hr)
Chicken Guinea (1hr)
Dengue (1hr)
Lymphatic Filariasis (1hr)
Pneumonia (1hr)
Hypertension (1hr)
Diabetes mellitus (1hr)
Cancer (1hr)
Drug addiction-drug substance abuse (1hr)

UNIT III **4 Hours**

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control program, Integrated disease surveillance program (IDSP) (1hr)

National leprosy control program, Immunity and immunizing agents, Universal immunization program, Family Planning Methods (1hr)
National mental health program, National program for prevention and control of deafness (1hr)
National program for control of blindness, Pulse polio program (1hr)

UNIT IV **5 Hours**

National health intervention program for mother and child (1hr)
National family welfare program, National tobacco control program (1hr)
National Malaria Prevention Program, National program for the health care for the elderly (1hr)
Social health program; role of WHO in Indian national program, TB and RNTCP (1hr)
Improvement in rural sanitation, national urban health mission, Health promotion and education in school (1hr)

UNIT V **1 Hours**

Community services in rural, urban and school health: Functions of PHC (1hr)

UNIT VI **2 Hours**

Biomedical Waste Management: Types of biomedical waste (1hr)
Principle of segregation and processing of bio-waste (1hr)

TEXT BOOKS:

1. Prabhakara GN. Short Textbook of Preventive and Social Medicine, 2nd edn.: Jaypee Publications; India 2010.
2. Mahajan BK and Gupta MC. Textbook of Preventive and Social Medicine .4th edn. Jaypee Publications. India: 2013.
3. Park K, Park Textbook of Preventive and Social Medicine, 24th edn. Banarsidas bhanot Publishers; India:2017.

REFERENCE BOOKS:

1. Jain V. Review of Preventive and Social Medicine, 10th edn. Jaypee Publications; India: 2018.
2. Ramesh A, Community Pharmacy Practice, 1st edn. BSP publishers; Hyderabad; 2020.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Environmental Sciences (T)	**2**	**0**	**0**	**30**	**2**	**III**	**BP307T**

SCOPE: Environmental Sciences is the scientific study of the environment. It includes the different components with which the environment is made of and the way in which it works in a sustainable way.

Study of environmental sciences includes the impact of human activity in the environment so as to find ways and means to avoid the negative impact of human activity. For this the study includes not only the physical, chemical, geological and biological characters of the environment but also the social and cultural factors of human societies.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: List different types of natural resources.
K2: Identify the difference between the types of natural resources.
K3: State the concept of sustainable development.
K4: Describe the concept of ecosystem.
K5: Outline the nature and importance of biodiversity.
K6: Enumerate different types of materials that cause pollution.

SKILL

S1: Distinguish the importance of components, structure and function of an ecosystem.
S2: Assess the different threats to biodiversity and different types of conservation.
S3: Categorize the impacts of different types of pollutants in the aerial environment.
S4: Categorize the impacts of different types of pollutants in aquatic environment.
S5: Categorize the impacts of different types of pollutants in terrestrial environment.
S6 : Categorize the impacts of Hospital waste, Hazardous waste.

ATTITUDE

A1: Appreciate the arrangement of components for attaining the structure and function of the ecosystem.
A2: Participate in alleviating the threats to ecosystems
A3: Cooperate in the conservation of biodiversity

A4: Assess the impacts of different pollutants on the environment and in the wellbeing of organisms.

A5: Justify the need of environment friendly concepts

A6: Justify the need of environment friendly management plans to reduce the negative impact on the environment

COURSE CONTENTS

UNIT I **8 Hours**

1. Renewable and non renewable Natural resources. (1hr)
2. Over exploitation and conservation of natural resources -- forest, water. (1hr)
3. Food, energy. (2hrs)
4. Mineral and land resources. (1hr)
5. Concept of sustainability, sustainable development. (1hr)
6. Concept of zero waste. (1hr)
7. Concept of three R's (Reduce, Reuse and Recycle). (1hr)

UNIT II **10 Hours**

1. Concept of ecosystem. Types of ecosystems, Components of an ecosystem. (1hr)
2. Structure and function of an ecosystem. (1hr)
3. A brief description of forest ecosystem. (1hr)
4. Food chain and food web, ecological pyramids. (1hr)
5. Biogeochemical cycle: examples (nitrogen and phosphorous). (1hr)
6. Threats to ecosystems. (1hr)
7. Biodiversity, types of biodiversity. (1hr)
8. Hot spots of biodiversity. (1hr)
9. Threats to biodiversity. (1hr)
10. Conservation of biodiversity. (1hr)

UNIT III **(12 Hours)**

1. Pollution of air and its impact. (1hr)
2. Acid rain. (1hr)
3. Global warming and climate change. (1hr)
4. Ozone layer depletion. (1hr)
5. Water pollution and its impact. (1hr)
6. Soil pollution and its impact. (1hr)
7. Industrial and urban solid wastes, Hospital waste, Hazardous waste. (1hr)
8. Plastic pollution, E-waste.. Disposal of solid wastes. (1hr)

9. Ecological foot prints-brief description of carbon footprint and water footprint. (1hr)
10. Industrial ecosystems. (1hr)
11. Green technology, Green business, Green buildings, (1hr)
12. Sustainable (green) cities. (1hr)

TEXT BOOKS :

1. Deswal S and Deswal A -- A basic course in environmental studiesDhanpat rai and Co (P) Ltd.
2. Palanisamy P. N., Manikandan P., Geetha A., Manjula Ran – Environmental Science, Pearson Education.
3. Singh, Y.K. -- Environmental Science, New Age International Pvt, Bangalore (Publishers)
4. Agarwal, K.C. -- Environmental Biology, Nidi Publ. Ltd. Bikaner. 2001
5. Bharucha Erach - The Biodiversity of India, Mapin Publishing Pvt.Ltd.,Ahmedabad–380013,India,

REFERENCE BOOKS:

1. Clark, R.S. Marine Pollution. Clanderson Press, Oxford, 2001.
2. Cunningham, W.P. and Saigo,. Environment Science. McGraw-Hill, USA B.W. 1997
3. Jacob Thomas – Environmental management: Text and Cases. Pearson.
4. Rajagopalan R. – Environmental Studies: From crisis to cure. Oxford University Press.

WEBSITES:

1. http://environmentalartilces.wordpress.com/bhopal-gas-tragedy-20-years-after/
2. *en.wikipedia.org/wiki/Environmental science*
3. http://india.gov.in/sectors/environment/environmental_education.php

**Latest edition of text books and reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Amrita Value Programme-Strategic Lessons From Mahabharata (T)	**1**	**0**	**0**	**15**	**1**	**III**	22ADM201

SCOPE: The course is designed to impart knowledge about Mahabharata's depths and richness and its eternal values with respect to our Indian culture. To equip students with a knowledge of this epic and enable them to make a distinction between *dharma* and *adharma*, *right* and *wrong*, *morality* and *immorality*, and *goodness* and *badness* with an emphasis on Kaurvas (represented evil) and Pandavas (symbolized for goodness). The epic also discusses the inspirational female characters and regional tales from Mahabharata to gain a coherent understanding of its Indian values and culture. This epic also critically analyzes the four goals of life: *kama* (pleasure), *artha* (wealth), *dharma* (duty) and *moksha* (liberation).

This epic also takes into consideration of Shri Krishna's strategies in Mahabharata, and lessons of dharma in Bhagavad Gita, and correlates them with present strategic management concepts. The strategic lessons from Mahabharata identify strategies and divinations that lie latent in this Ishihasa and convey them to the students for further ruminations.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to ;

KNOWLEDGE

K1: Discuss the foundational concepts of Mahabharata (Understanding)

K2: Describe the characteristics of the classical Indian epic, with special reference to the Mahabharata. (Understanding)

K3: Explain the stories of Adi-Parva, Sabha-Parva, Aranyaka-Parva, Virata-Parva, Udyoga-Parva and Bhishma-Parva(Understanding)

K4: List the most important aspect of Bhishma Parva as Bhagavad Gita(Understanding)

K5: Discuss the stories of Drona-Parva, Karna-Parva, Shalya-Parva, Sauptika-parva, Stri-parva, Shanti-Parva and Anusasana-parva(Understanding)

K6: Enumerate the stories of Ashvamedhika-parva, Ashramavasika-parva, Mausala-parva, Mahaprasthanika-parva and Svargarohana-parva(Understanding)

SKILL

S1: Incorporate various strategic lessons suggested in Mahabharata in day-to-day life.

S2: Apply the principles of life skill ideas discussed in Mahabharata for materialistic life

S3: Design what Mahabharata is and what it is not, its contemporary relevance, and how it becomes part of Indians' day-to-day life

S4: Analyse inspirational female characters and regional tales from Mahabharata to gain a coherent understanding of its Indian values and culture.

S5: Assemble the imperativeness of Mahabharata in everyday life.

S6: Critically evaluate an overall idea of its contents, the multifarious lessons and possibilities of Mahabharata.

ATTITUDE

A1: Embrace the powerful influence of a good attitude on life and happiness

A2: Appreciate female characters, regional tales, traditions, and the spirit of harmonious living.

A3: Appreciate the relevance of Mahabharata for modern times.

A4: Follow the concepts of learning to live together, develop the attitude of sharing and care for a fellow being

A5: Display an attitude of honesty and sincerity and take responsibility for the societal needs

A6: Follow the principle of Mahabharata and Practicing self-compassion for others

COURSE CONTENTS

UNIT I -IV **4 Hours**

Mahā bhā rata - A Brief Summary (1hr)
A Preamble to the Grand Itihā sa (1hr)
The Unbroken Legacy (1hr)
Dharmic insights of a butcher (1hr)

UNIT V –VIII **4 Hours**

The Vows we take: Pratijñā (1hr)
Mahā bhā rata - The Encyclopaedia for Kingship and Polity Acumen (1hr)
Karna: The Maestro that Went Wide of the Mark (1hr)
Strategical Silhouette of An Extraordinary Peace Mission (1hr)

UNIT IX- XI **4 Hours**

Yajñaseni, A Woman from Fire (1hr)
Popular Regional Tales (2hr)
Death and Deathlessness (1hr)

UNIT XII- XIV **3 Hours**

Mahabharata- An All-Encompassing Text (1hr)
Mahabharatha- Whats and What Nots (1hr)
Mahā bhā rata in Adages (1hr)
Mahabharata

TEXT BOOK:

1. Achyutamrita Chaitanya. Strategic lessons from Mahabharata. Kollam. Amrita books. 2022.

REFERENCE BOOK:

2. Bibek Debroy. The Mahabharata. Penguin. India. 2015
3. Jayadayal Goyadka. Some Exemplary Characters of the Mahabharata. Shri Ji Books. India. 2021.
4. C. Rajagopalachari. Mahabharata. Bharatiya Vidya Bhavan.,41st edn. 2001

**Latest edition of the text books & reference books can be referred*

SEMESTER-IV

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Organic Chemistry –III (T)	**2**	**0.5**	**0**	**30**	**2.5**	**IV**	**BP401T**

SCOPE: This course imparts knowledge of stereo-chemical aspects of organic compounds and organic reactions, important named reactions, and the chemistry of important heterocyclic compounds. The course deals with optical isomerism, elements of symmetry, and sequence rule of optically active agents. The course also covers racemic modification, resolution, and asymmetric synthesis. Introduction of geometrical isomerism, methods of determining the configuration of geometrical isomers, atropisomerism, and stereospecific and stereoselective reactions were described.

The syllabus emphasizes the synthesis and reactions of various classes of heterocyclic compounds. The course also deals with various naming reactions of reduction, oxidation and rearrangement reactions.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Describe the synthesis and reactions of heterocyclic ring-containing compounds (Remembering).
K2: Explain the basic principles of stereospecific/stereoselective reactions and asymmetric synthesis (Comprehension).
K3: Apply the basic concepts between stereo and geometrical isomerism with examples (Application).
K4: Determine the synthetic importance of organic naming reactions (Analysis).
K5: Categorize the different mechanisms of reduction reactions (Synthesis).
K6: Predict the orientation of electrophilic substitution reactions of heterocyclic compounds (Evaluation).

SKILL

S1: Demonstrate the resolution of racemic mixtures.
S2: Differentiate the D & L system of nomenclature of optical isomers, sequence rules, R&S system of optical isomers.
S3: Perform various types of rearrangement reactions.
S4: Identify the various types of reduction reactions.
S5: Detect the aromaticity and orientation of heterocyclic compounds.
S6: Analyse the various types of oxidation reactions.

ATTITUDE

A1: Support others to learn and explore further

A2: Participate actively with a positive mind-set
A3: Embrace and be open to new ideas.
A4: Cooperate with students and others in the lab activities.
A5: Develop critical thinking of new schemes.
A6: Be sincere, punctual and ethical.

COURSE CONTENTS

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

UNIT I **9 Hours**

Stereo Isomerism:

Optical isomerism – Optical activity, enantiomers, diastereoisomerism, meso compounds (1 hr)
Elements of symmetry, chiral and achiral molecules (2 hrs)
D &L system of nomenclature of optical isomers, sequence rules, R&S system of nomenclature of optical isomers (2 hrs)
Racemic modification and resolution of racemic mixture. (3 hrs)
Asymmetric synthesis: partial and absolute (1 hr)

UNIT II **5 Hours**

Geometrical isomerism:

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) (1 hr)
Methods of determination of configuration of geometrical isomers (1 hr)
Conformational isomerism in Ethane, n-Butane and Cyclohexane. (1 hr)
Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. (1 hr)
Stereospecific and stereo selective reactions(1 hr)

UNIT III **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives:
Pyrazole, Imidazole, Oxazole and Thiazole.(3 hrs)
Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine. (3 hrs)
Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives. (2 hrs)

UNIT IV **8 Hours**

Reactions of synthetic importance

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birchreduction, Wolff Kishner reduction. (3 hrs)
Oppenauer-oxidation and Dakin reaction. (2 hrs)
Beckmanns rearrangement and Schmidt rearrangement. (2 hrs)
Claisen-Schmidt condensation (1 hr)

TEXT BOOKS:

1. Agarwal O.P. Reactions and reagents. 56th edn. Goel Publishing house, India;2023
2. Bansal R.K, Heterocyclic chemistry. 6th edn. New age international private limited.; India:2019
3. Finar I.L. Organic Chemistry. 6th edn. Pearson Education India; India: 2002. (Volume-I & II)

REFERENCE BOOKS:

1. Morrison, R. T., & Boyd, R. N. *Organic chemistry*. 7th edn. Boston: Allyn and Bacon; 2010.
2. Gilchrist L.T. Heterocyclic chemistry. 3rd edn. Pearson publishers; India: 1997
3. BruiceP. Y.Organic Chemistry. 8th edn. Upper Saddle River, NJ: Pearson Education; 2015.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Medicinal Chemistry-I (T)	**3**	**0.5**	**0**	**45**	**3.5**	**IV**	**BP402T**

SCOPE: Medicinal Chemistry-I applies the principles and techniques of chemistry to identify, design, and optimize compounds that can be used as drugs for the treatment of various diseases. The course includes the development, chemical classification, chemical structure, synthesis, mechanism of action, and uses of important classes of given medicinal compounds. This course will introduce students to structure activity relationships, which helps to predict and evaluate the therapeutic effects of different drugs.

Additionally, the course will demonstrate the significance of physicochemical parameters in the biological action of various therapeutic agents. Overall, the course medicinal Chemistry-I makes the students to understand the basics of drug discovery, design, and development of various therapeutic agents focused on improving human health.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Classify the medicinal compounds based on the chemical structure
K2: Interpret the Structural Activity Relationship of different class of drugs
K3: Identify the effects of physicochemical properties on biological action and drug metabolic pathways
K4: Outline the synthetic pathway of medicinally important drug molecules
K5: Correlate the mechanism of action and the therapeutic value of drugs
K6: Apply the principles and techniques of chemistry in the design and synthesis of therapeutic agents

SKILL

S1: Demonstrate the synthetic pathway of new therapeutic agents
S2: Analyse the effects of various functional groups in the therapeutic activity of drugs
S3: Determine the drug targets and its therapeutic potential with respect to drug development
S4: Apply the significance of physicochemical parameters in the therapeutic actions of drugs
S5: Differentiate the important medicinal drugs into water soluble and lipid soluble based on their structure
S6: Predict the binding affinity of drugs to receptors based on the different chemical substituents

ATTITUDE

A1: Participate in group discussions for the design of a new synthetic pathway of therapeutic agents
A2: Appreciate the relevance of Structural Activity Relationship in the biological action of drugs
A3: Assist in classifying the drugs based on the heterocyclic rings present in the compound
A4: Recognise the contribution of Medicinal Chemists, Scientists and Pharmacists involved the discovery and development of drugs
A5: Accept the significance of Medicinal Chemistry in the healthcare system
A6: Follow a safe, green and eco-friendly approach in developing the synthetic scheme of medicinal compounds

COURSE CONTENTS

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT 1 **6 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry (1hr)
Physicochemical properties in relation to biological action:
Ionization, Solubility, Partition Coefficient, Hydrogen bonding (2 hrs)
Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism (2 hrs)
Drug metabolism: Drug metabolism principles- Phase I and Phase II, Factors affecting drug metabolism including stereo chemical aspects. (1hr)

UNIT II **10 Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine, Adrenergic receptors: Alpha & Beta and their distribution (1 hr)
Sympathomimetic agents: SAR of Sympathomimetic agents (1hr)
Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Dobutamine, Isoproterenol, Terbutaline, Methyldopa, Clonidine (2 hrs)
Salbutamol,Naphazoline, Oxymetazoline and Xylometazoline (1hr)
Indirect acting agents: Amphetamine, Methamphetamine, Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine (1 hr)
Agents with mixed mechanism: Ephedrine, Metaraminol (1 hr)

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine. (1 hr)
Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Labetolol, Atenolol, Bisoprolol, Esmolol, Metoprolol, Carvedilol. (2 hrs)

UNIT III **10 Hours**

Drugs acting on Autonomic Nervous System

Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine, Cholinergic receptors (Muscarinic & Nicotinic) and their distribution (1hr)

Parasympathomimetic agents: SAR of Parasympathomimetic agents (1hr)

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine (1hr)

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Cholinesterase reactivator: Pralidoxime chloride (3 hrs)

Cholinergic Blocking agents: SAR of cholinolytic agents, Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide* (2 hrs)

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Procyclidine hydrochloride*, Glycopyrrolate, Methantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride (2 hrs)

UNIT IV **11 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem (1hr)

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital (1hr)

Miscelleneous: (1hr)

Amides & imides: Glutethmide

Alcohol & their carbamate derivatives: Meprobomate.

Aldehyde & their derivatives:Paraldehyde

B. Antipsychotics

Phenothiazines**:** SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. (2hrs)

Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine (1hr)

Fluro buterophenones: Haloperidol, Droperidol, Risperidone. Beta amino ketones: Molindone hydrochloride. Benzamides: Sulpieride (1hr)

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin (1hr)

Oxazolidine diones: Trimethadione(1hr)

Succinimides: Ethosuximide*

Urea and monoacylureas: Carbamazepine* (1hr)

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate (1hr)

UNIT V **8 Hours**

Drugs acting on Central Nervous System

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine (1hr) Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Pentazocine, Levorphanol tartarate. (2 hrs)

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. (1hr)

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*,Indomethacin, Sulindac (2hrs)

Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam,Acetaminophen, Phenylbutazone (2hrs)

TEXTBOOKS:

1. Williams D.A. Foye's Principles of Medicinal Chemistry, 8th edn, LPPWW Publishers Philadelphia, 2020.
2. Ilango K, Valentina P. Text Book of Medicinal Chemistry, Vol. I & II. 2nd edn, Keerthi Publishers, Chennai, 2015.

REFERENCE BOOKS:

1. Wilson and Gisvold’s Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th edn, Lippincott Williams & Wilkins: New Delhi, 2011.
2. Chackalamannil. S, Rotella D.P, Ward S.E. Comprehensive medicinal chemistry, 3rd edn, Elsevier: Netherlands, 2017
3. Hansch.C. Comprehensive Medicinal Chemistry, Vol. 1-6, 1st edn, Re. Pergamon Press, England, 2012.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Physical Pharmaceutics-II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**IV**	**BP403T**
Physical Pharmaceutics-II (P)	**0**	**0**	**2**	**30**	**1**	**IV**	**BP408P**

SCOPE: The course deals with the various physicochemical properties of drugs and excipients essential for formulation development. It focused on formulations like colloids and course dispersion and their stabilization. It includes flow properties, properties of small particles and reaction kinetics, which helps in pharmaceuticals' standardization and shelf life determination.

In the laboratory, students perform important experiments like viscosity, zeta potential and expiry date determination of pharmaceuticals. In the classroom students participate in group discussion, individual performance, and challenging tasks, which helps to potentiate students' collaborative behavior, personality growth and compassion.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, student shall be able to;

KNOWLEDGE

K1: Classify colloids.
K2: Explain different types of order of reactions.
K3: Discuss stabilization methods of colloidal and coarse dispersion.
K4: Classify the theory of emulsification.
K5: Criticize hydrolysis, oxidation and photilytic reactions on drug degradation.
K6: Differentiate different rheological behavior of fluids.

SKILL

S1: Implement the principles of chemical kinetics to stabilize medicinal agents and determination of expiry date of formulations.
S2: Measure the reaction rate constant and half-life of various order of reactions
S3: Demonstrate flow properties of powder/granules.
S4: Comment on the zeta potential for the stability of the dispersed system.
S5: Estimate the optimum concentration of suspending agents.
S6: Assess the viscosity of fluids.

ATTITUDE

A1: Appreciate the work of others.
A2: Be sincere and punctual.
A3: Follow Good Laboratory Practice guidelines.
A4: Participate actively in the discussion during class.
A5: Support your team members for better outcomes.
A6: Share and care for good harmony and work culture.

UNIT I **6 Hours**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles,(1hr)
Classification of colloids, comparative account of their general properties(1hr)
Method of preparation (1hr).
Optical, kinetic(1hr)
Electrical properties. Effect of electrolytes(1hr),
Coacervation, peptization & protective action.(1hr)

UNIT II **6 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature(1hr)
Non-Newtonian systems, pseudoplastic, dilatant, plastic,(1hr)
Thixotropy, thixotropy in formulation, (1hr)
Determination of viscosity capillary, falling Sphere, rotational viscometers (2 hrs)
Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain,Elastic Modulus (1hr)

UNIT III **5 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, (1hr)
Formulation of flocculated and deflocculated suspensions.(1hr)
Emulsions and theories of emulsification, (1hr)
Microemulsion and multiple emulsions, Stability problem and method to overcome,(1hr)
Preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method. (1hr)

UNIT IV **6 Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, (1hr)
Methods for determining particle size by different methods: nano size range DLS, laser scattering , (2 hrs)
Counting and separation method, particle shape, specific surface, methods for determining surface area, (1hr)
Permeability, adsorption, (1hr)
Derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties(1hr)

UNIT V **7 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, (2hrs)

Determination of reaction order. (1hr)

Physical and chemical factors influencing the chemical degradation of pharmaceutical products: temperature, solvent, ionic strength, dielectric constant, specific & general acid-base catalysis (2hrs)

Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. (1hr)

Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention (1hr)

LIST OF EXPERIMENTS

1. Determination of particle size, and particle size distribution using Microscopic method.
2. Analyse the particle size and zeta potential by dynamic light scattering (DLS).
3. Calculate bulk density, true density and porosity.
4. Optimize the concentration of lubricant through the angle of repose method.
5. Estimate of viscosity of liquid using Ostwald's viscometer.
6. Compare the sedimentation volume of different suspending agent.
7. Optimize concentration of Single suspending agent.
8. Analyse the viscosity of semisolid by using Brookfield viscometer.
9. Calculate of reaction rate constant and half-life of the pseudo first-order reaction.
10. Estimate of reaction rate constant and half-life of a second-order reaction.
11. Establish the shelf life of pharmaceuticals by accelerated stability studies.

TEXT BOOKS:

1. Martin A, Bustamante P, Chun AHC. Physical Pharmacy, Physical Chemical Principles in Pharmaceutical Sciences. 4th edn, Lippincott Williams and Wilkins, Philadelphia, 2001.
2. Sateesha SB & Rajamma AJ. Physical Pharmaceutics Principles of Formulation: Buy Physical Pharmaceutics Principles of Formulation, 1st edn, EMMESS Medical publishers, Bangalore, 2020.
3. Subrahmanium CVS. Physical Pharmaceutics. 2nd edn, Vallabh Prakashan, Delhi, 2000.

REFERENCES BOOKS:

1. Remington: The Science and Practice of Pharmacy. 23rd edn, Elsevier, 2020.
2. Subramanyam CVS,Settee JT. Laboratory Manual of Physical Pharmaceutics.Vallabh Publication. 2014

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacology-I (T)	**3**	**0.5**	**0**	**45**	**3.5**	**IV**	**BP404T**

SCOPE: The course aims to comprehend the science behind drugs and how they interact with the human body. Knowledge of pharmacology can contribute to the development of new medications by studying the effects of drugs on cells, tissues, and organisms. It helps to explore potential therapeutic targets, design and synthesize new compounds, and assess their safety and efficacy. It provides knowledge of drug-receptor interactions, signal transduction pathways, and the impact of drugs on physiological processes to understand their mechanisms of action.

The course offers insights into how drugs are processed by the body, including factors such as bioavailability, drug clearance, and drug-drug interactions. It delivers the safety of medications, identifies potential side effects, and determines appropriate dosage regimens to minimize adverse reactions. Besides, it imparts a better understanding of drug response variability among individuals, pharmacogenetics, and drug interactions, and guides dose and drug selection. Additionally, it helps in pursuing careers in academia, conducting research to expand knowledge in pharmacology and teaching future scientists and healthcare professionals.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Describe the scientific terms and principles of pharmacology

K2: List the different classes of clinically relevant drugs used for various diseases/disorders affecting ANS and CNS

K3: Illustrate the mechanistic role of drugs in modifying neuro-transmission in ANS and CNS disorders

K4: Discuss the pharmacological actions of drugs at organ system/sub-cellular/ macromolecular levels, pharmacokinetics, and dose of drugs used in the treatment of different diseases/disorders that affect ANS and CNS

K5: Predict the mechanism of drugs that contribute to adverse drug reactions and contraindications

K6: Explain the pharmacological and non-pharmacological management of disorders of ANS and CNS

SKILL

S1: Justify the relevance of drugs in the pharmacological management of various disorders

S2: Predict the drug interactions in a given prescription

S3: Recommend the possible alternatives to the drug therapy

S4: Identify the signs and symptoms of drug poisoning
S5: Convince the public about the need for drug therapy in a disorder/disease
S6: Educate patients about the do's and don'ts in a drug therapy

ATTITUDE
A1: Appreciate the knowledge of Pharmacology for learning pharmacotherapy and toxicology.
A2: Communicate with peers and others.
A3: Support and collaborate with others.
A4: Exhibit professionalism in the working environment.
A5: Participate in healthcare initiatives.
A6: Embrace the new advancements in the healthcare system.

COURSE CONTENTS:

UNIT I **7 Hours**

General Pharmacology

a. Introduction to Pharmacology

Definition and scope of pharmacology (1hr)
Nature and source of drugs, routes of drug administration (1hr)
Agonists, antagonists (competitive and non-competitive), partial agonists and inverse agonists (1hr)

b. Pharmacokinetics

Absorption of drugs (1hr)
Distribution of drugs (1hr)
Metabolism of drugs (1hr)
Excretion of drugs, Kinetics of Elimination (1hr)

UNIT II **9 Hours**

General Pharmacology

Pharmacodynamics

Principles and mechanisms of drug action. (1hr)
Classification of receptors, regulation of receptors, drug receptors interactions signal transduction mechanisms (1hr)
G-protein–coupled receptors, ion channel receptors (1hr)
transmembrane enzyme-linked receptors, transmembrane JAK-STAT binding receptors and receptors that regulate transcription factors (1hr)
Spare receptors, dose-response relationship, therapeutic index (1hr)
Adverse drug reactions (1hr)
Drug interactions (pharmacokinetic and pharmacodynamic) and factors modifying drug action (1hr)
Enzyme induction, enzyme inhibition, Drug addiction, tolerance, dependence, drug abuse, tachyphylaxis, idiosyncrasy and allergy (1hr)
Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance. (1hr)

UNIT III **9 Hours**

Pharmacology of drugs acting on the ANS

Neurohumoral transmission, co-transmission and receptors involved in the neurotransmission (1hr)

Drugs acting on ANS

Adrenergics (2hrs)

Anti-Adrenergics (1hr)

Cholinergics (1hr)

Anticholinergics (1hr)

Neuromuscular blocking agents and skeletal muscle relaxants (1hr)

Local anaesthetic agents (1hr)

Drugs used in myasthenia gravis and glaucoma (1hr)

UNIT IV **9 Hours**

Pharmacology of drugs acting on the central nervous system

Receptor-mediated actions of neurotransmitters like GABA, Glutamate, Glycine, serotonin, and dopamine (2 hrs)

Alcohol and disulfiram (1hr)

General anaesthetics: Stages of anaesthesia, General anaesthetics drug pharmacology, Pre-Anaesthetic medications (1hr)

Sedatives and hypnotics (1hr)

Anti-epileptics (2hrs)

eDrugs used in Parkinson's disease and Alzheimer's disease (2hrs)

UNIT V **7 Hours**

Pharmacology of drugs acting on the central nervous system

Psychopharmacological agents:

Antipsychotics (1hr)

Antidepressants (1hr)

Anti-anxiety agents (1hr)

Anti-maniacs and Hallucinogens. (1hr)

CNS stimulants and nootropics (1hr)

Endogenous opioid peptides and their receptors, Opioid analgesics and antagonists (2hrs)

UNIT VI **3 Hours**

SIMULATED Experiments in pharmacology

Demonstrate the effect of drugs acting on ciliary motility of frog oesophagus and rabbit's eye (1 hr)

Demonstrate the effects of skeletal muscle relaxants, anxiolytics, anticonvulsants, CNS stimulants and CNS depressants in various animal models(1 hr)

Discuss novel drugs approved by FDA/CDSCO and banned drugs acting on ANS and CNS (1hr)

TEXT BOOKS:

1. James R, Rod F, Graeme H, Yoon KL, David, Humphrey R. Rang & Dale's Pharmacology. 9th edn.Churchill Living Stone: Edinburgh Elsevier; 2020
2. Tripathi KD. Essentials of medical pharmacology. 8th edn. Jaypee: Delhi; 2018
3. Ghosh MN. Fundamentals of Experimental Pharmacology. 7th edn. India: Hilton & Company;2019.

REFERENCE BOOKS:

1. Laurence LB, Randa HD, Björn CK. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 13th edn.McGraw Hill: New York; 2017
2. Satoskar RS, Bhandarkar SD, Nirmala N. Pharmacology and Pharmacotherapeutics. 26th edn. Popular Prakashan; 2020.
3. Whalen K. Lippincott Illustrated Reviews: Pharmacology. 8th edn.Wolters Kluwer (India) Pvt. Ltd; 2022.
4. Gupta SK. Drug Screening Methods.3rd edn. New Delhi, India: Jaypee Brothers Medical Publishers (P) Ltd; 2016.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacognosy And Phytochemistry II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**IV**	**BP405T**
Pharmacognosy And Phytochemistry II (P)	**0**	**0**	**3**	**30**	**1.5**	**IV**	**BP409P**

SCOPE: The course provides a comprehensive understanding of biosource, chemistry and therapeutic uses of the phytochemicals and their isolation, identification and analysis techniques. It imparts the knowledge about the biosynthetic pathways in higher plants.

The course deals with the industrial production, estimation and utilization of some therapeutically important phytoconstituents. Also, the course helps to get a better insight into various aspects such as extraction, isolation, analysis and identification of phytoconstituents. It enables students to apply modern methods for extraction of the herbal drugs (such as ultrasound and microwave-assisted extraction), isolation of volatile oils and use of various analytical techniques for the identification of phytoconstituents.

COURSE LEARNING OUTCOMES

Upon completion of the course, the student shall be able to;

KNOWLEDGE

K1: Describe the metabolic pathways in higher plants.

K2: Discuss the utilization of radioactive isotopes in the investigation of biosynthetic pathways.

K3: Explain source, chemistry, therapeutic uses of various secondary metabolites containing drugs.

K4: Describe methods for industrial production, estimation and utilization of some therapeutically important phytoconstituents.

K5: Apply modern methods for extraction of the herbal drugs.

K6: Compare the process of isolation and identification of therapeutically important phytoconstituents.

SKILL

S1: Evaluate the crude drugs by microscopic and morphological methods

S2: Choose different extraction techniques to carryout isolation of phytoconstituents.

S3: Apply the analytical techniques for the identification of phytoconstituents.

S4: Identify unorganized drugs by qualitative chemical tests.

S5: Demonstrate the method for isolation of volatile oils.

S6: Identify different crude drugs based on their organoleptic characters.

ATTITUDE

A1: Develop a compassionate and supportive attitude.
A2: Adopta habit of introspection to enhance personal growth.
A3: Cultivate a sense of social responsibility.
A4: Adapt to changing circumstances with a positive attitude.
A5: Develop a growth mindset, embracing challenges.
A6: Collaborate and co-operate with fellow students and others.

COURSE CONTENTS

UNIT I **7 Hours**

Metabolic pathways in higher plants and their determination

Brief study of basic metabolic pathways:
Shikimic acid pathway (1 hr)
Acetate pathways (1 hr)
Amino acid pathways (1 hr)
Formation of different secondary metabolites (tropane alkaloids, cardiac glycoside,anthraquinones) through these pathways.(2hrs)
Study of utilization of radioactive isotopes in the investigation of Biogenetic studies (2 hrs)

UNIT II **8 Hours**

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins. (3 hrs)

Biosources, chemistry & chemical classes, therapeuticuses and commercial applications of following secondary metabolites;Pharmacognostical Scheme of important drugs (Superscripted by *):

Alkaloids: Vinca, Rauwolfia, Belladonna, *Opium (1hr)
Phenylpropanoids and Flavonoids: Lignans,Tea
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, *Digitalis (1hr)
Volatile oils: *Clove, * Cinnamon, *Fennel, Coriander. (1hr)
Tannins: Catechu,Pterocarpus.
Resins: Guggul, Ginger, Benzoin, Colophony,Asafoetida.(1hr)
Glycosides: Senna, Aloes.
Iridoids, Other terpenoids&Naphthaquinones: Artemisia, taxus, carotenoids,Gentian(1hr)

UNIT III **3 Hours**

Isolation, Identification and Analysis of Phytoconstituents

Glycosides: Glycyrhetinic acid
Resins: Curcumin (1hr)
Terpenoids: Citral, Menthol (1hr)
Alkaloids: Quinine, Reserpine,Caffeine (1hr)

UNIT IV **4 Hours**

Industrial production, estimation and utilization of the following phytoconstituents:

Sennoside, Digoxin, Diosgenin(1hr)

Atropine, Vincristine and Vinblastine (1hr)
Forskolin, Artemisinin, Taxol Podophyllotoxin(2hrs)

UNIT V **8 Hours**

Basics of Phytochemistry

Conventional methods: Maceration, Digestion, Decoction, Infusion, Percolation SoxhletExtraction. (1hr)

Modern techniques for extraction phytoconstituents: Counter current extraction, super critical fluid extraction, ultrasound-assisted, and microwave-assisted extractions. (2hrs)

Methods for isolation of volatile oil. (1hr)

Application of different chromatographic techniquesand electrophoresis in the isolation, purification of phytoconstituents. (2hrs)

Application of Spectroscopic techniques [UV-Vis, Fluorescence, IR, NMR, MASS] for the identification of crude drugs. (2hrs)

LIST OF EXPERIMENTS:

1.Morphology, histology and powder characteristics & extraction& detection of:
Cinnamon, Senna, Clove, Ephedra, Fennel

2. Exercise involving isolation & detection of active principles
   a) Caffeine - from tea dust.
   b) Ultrasound and microwave assisted extraction of diosgenin from Dioscorea
   c) Microwave assisted extraction of curcuminoids from *Curcuma longa*
   d) Glycyrhetinic acid from Liquorice
3. Separation of sugars by Paper chromatography
4. TLC of phytoconstituents (Caffeine, Clove oil, Diosgenin,Curcumin)
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests:
   (i) Asafoetida (ii) Benzoin (iii)Colophony (iv) Aloes (v) Myrrh
7. Spotting for identification of crude drugs mentioned in the theory.
8. General Test for identification of secondary metabolites (Alkaloids, Steroids, Flavonoids, Tannins)

TEXT BOOKS:

1. Evans WC. Trease and Evans Pharmacognosy. 16th edn. W.B. Sounders & Co.; London: 2009.
2. Kalia AN. Textbook of Industrial Pharmacognosy. 1st edn. CBS Publishers; New Delhi: 2009.
3. Agrawal SS, Paridhavi M. Herbal drug technology. 2nd edn. Universities Press; Hyderabad: 2007.

REFERENCE BOOKS:

1. Ali M. Pharmacognosy and Phytochemistry. Vol. I & II, 1st edn. CBS Publishers & Distribution; New Delhi: 2009.
2. Mukherjee PK. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. 1st edn. Business Horizons Publishers; New Delhi: 2002.
3. Kokate CK, Purohit AP, Gokhlae SB. Practical Pharmacognosy. 13th edn. NiraliPrakashan; New Delhi: 2009. (Practical)
4. Iyengar MA, Nayak SGK. Anatomy of Crude Drugs. 12th edn. PharmaMed Press; Hyderabad:2011. (Practical)

ADDITIONAL READING MATERIALS:

1. Rangari VD. Pharmacognosy and Phytochemistry. Vol. I & II, 3rd edn. Career Publications; Nashik: 2017.
2. Iyengar MA, Pharmacognosy of Powdered Crude Drugs, 10th edn. PharmaMed Press; Hyderabad: 2000.
3. Kokate CK, Purohit AP, Gokhlae SB. Text book of Pharmacognosy. 37th edn. NiraliPrakashan; New Delhi: 2007.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Jurisprudence (T)	**2**	**0.5**	**0**	**30**	**2.5**	**IV**	**BP406T**

SCOPE: Pharmaceutical jurisprudence is a specialised field that combines the principles of pharmacy and law. It focuses on the legal and regulatory aspects of the pharmaceutical industry, including the development, manufacturing, distribution, and use of drugs and healthcare products. This course is designed to impart basic knowledge on important legislation related to the pharmacy profession in India.

This course provides students with a comprehensive understanding of the legal and regulatory frameworks governing the pharmaceutical industry, including relevant legislation, regulations, and policies. It equips them with the knowledge and skills to navigate the complex legal landscape, address regulatory compliance issues, and contribute to the effective and ethical functioning of the pharmaceutical sector. **All the Acts and Rules shall be discussed giving emphasis on the latest amendments.**

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Explain key pharmaceutical laws and regulations.
K2: Enumerate the importance of Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals
K3: Review various Indian Pharmaceutical Acts and Laws
K4: Describe the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
K5: Adapt the code of ethics during the pharmaceutical practice
K6: Relate the various concepts of Drug policy, DPCO, Patent and Designing act

SKILL
S1: Predict specific drug approval processes and regulatory bodies.
S2: Interpret legal language and terminology used in drug laws and regulations.
S3: Summarise ethical guidelines and principles relevant to the pharmaceutical sector
S4: Assess the role of regulatory agencies in ensuring drug safety and efficacy.
S5: Adapt knowledge of pharmaceutical laws to assess compliance issues in the industry
S6: Analyze pharmaceutical laws and regulations and their implications for various stakeholders.

ATTITUDE

A1: Identify the societal impact of pharmaceutical practices and the need for responsible engagement.

A2: Express a receptive attitude towards learning about the impact of laws and regulations on the pharmaceutical industry.

A3: Apply legal principles to analyse and resolve ethical dilemmas in the pharmacy profession.

A4: Devalope an attitude of adherence to laws, regulations and standards governing the pharmaceutical industry.

A5: Cultivate a professional attitude towards a their role as Pharmacist demonstrating accountability responsibility and confidentiality

A6: Embrace the value of lifelong learning and staying updated with legal and ethical developments in the field.

COURSE CONTENTS

UNIT I **3 Hours**

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee (2 hrs)

Code of Pharmaceutical Ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath (1 hr)

UNIT II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**. (**2 hrs)

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.(2 hrs)

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) (2 hrs)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties) (2 hrs)

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors. (2 hrs)

UNIT III **8 Hours**

Pharmacy Act –1948

Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties(3 hr)

Medicinal and Toilet Preparation Act –1955 (2 hr)

Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic Substances Act-1985 and Rules(3 hrs)

Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and penalties

UNIT IV **6 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules (2 hrs)

Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960 (2 hrs)

Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority

Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM) (2 hrs)

UNIT V **3 Hours**

Medical Termination of Pregnancy Act: Termination of Pregnancies, Offences& Penalties, Rules& Regulations (1 hr)

Right to Information Act: Historical Background, Objectives, Features of the Act and its importance. Request for obtaining information, Exemptions. Designation of Public Information Officers; Constitution of Central and State Information Commissions; their Powers and Functions. Appeal and Penalties.(1 hr)

Introduction to Intellectual Property Rights (IPR): Different forms of IPR and their protection .(1 hr)

TEXTBOOKS:

1. B. M Mithal. Textbook of Forensic Pharmacy. 2nd edn, Vallabh prakashan, 2006.
2. N K Jain. A Textbook of forensic pharmacy. 8th edn,Vallabh prakashan, 2019.

REFERENCE BOOKS:

1. Drugs and Cosmetics Act/Rules by Govt. of India publications.
2. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
3. Narcotic drugs and psychotropic substances act by Govt. of India publications
4. Drugs and Magic Remedies act by Govt. of India publication
5. Bare Acts of the said laws published by Government.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Amrita Value Programme-Leadership Lessons From Ramayana (T)	**1**	**0**	**0**	**15**	**1**	**IV**	22ADM211

SCOPE: The course is designed to impart students to the depths and richness of Ramayana and its knowledge traditions. To equip students with practical knowledge learned from Ramayana and its characters for success in day-to-day life. The first chapter ***Balakanda*** deals with the origins and childhood of Rama. Sita's birth, betrothal, and marriage to Rama. The second chapter, ***Ayodhyakanda,*** includes the preparations for Rama's coronation in the city of Ayodhya, his exile into the forest, and the regency of Bharata. The third chapter **Aranya *Kanda*** contains the forest exile of Rama with Sita and Lakshmana. The kidnapping of Sita by the demon king Ravana. The fourth chapter ***Kishkinda kanda*** deals with Rama and Hanuman in Kishkindha. Chapter five ***Sundara kanda*** contains a detailed account of Hanuman's adventures, including his meeting with Sita. The sixth chapter ***Yudha Kanda*** includes the battle in Lanka between Rama and Ravana. Sita's fire ordeal. Rama's return to Ayodhya to reign over the ideal state. The seventh chapter ***Uthara kanda*** **includes** Sita's banishment. Lava and Kusha. Rama's dharma was fulfilled.

This epic also depicts vision and bringing different people together for a collective goal are unique qualities of a genuine leader like Rama and examples from Ramayana that are a source of motivation for leadership too.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Discuss general concepts of Great Itihasa (Understanding)

K2: Describe the characteristics of the classical Indian epic, with special reference to the Ramayana. (Understanding)

K3: Explain the stories of Balakanda, Ayodhya kanda, Aranya kanda and Kishkinda kanda

K4: Discuss the stories of Sundara kanda and Yudha kanda(Understanding)

K5: Describe the relevance of Ramayana and its learning aspects in modern life(Understanding)

K6: Explain the authenticity of Uttar Kanda and its attempt to explain the untold stories in the first six Kanda (Understanding)

SKILL

S1: Incorporate various strategic lessons mentioned in Ramayana for modern life.

S2: Apply the principles of life skill ideas discussed in Ramayana for materialistic life

S3: Design what Ramayana is and what it is not, its contemporary relevance, and how it becomes part of Indians' day-to-day life

S4: Analyse inspirational female characters and regional tales from Ramayana to gain a coherent understanding of it Indian values and culture.

S5: Appreciate and incorporate principles of Ramayana in everyday life.

S6: Interpret and incorporate an overall idea of its contents, the multifarious lessons and possibilities of Ramayana.

ATTITUDE

A1: Embrace the life principle of taking control of our thoughts

A2: Appreciate female characters, regional tales, traditions, and the spirit of harmonious living.

A3: Appreciate the principle of brotherhood and regular personal development in day-to-day life

A4: Follow a good attitude of compassion and love for others and practice mindfulness

A5: Appreciate life's purpose and live in alignment with our purpose

A6: Develop qualities of discipline, honesty, loyalty, and love.

COURSE CONTENTS

UNIT I - Introduction to the Great Itihasa (1hr)

UNIT II - Bala-Kāṇḍa: (Preparing for the renowned mission.(1hr)

And Ayodhya-Kāṇḍa: (Harbinger of an Entire Tradition of Nobleness**.)** (1hr)

UNIT III- Araṇya-Kāṇḍa: (Tale of the forest life) (1hr)

And Kishkindha-Kāṇḍa: (The Empire of Holy Monkeys.)(2 hrs)

UNIT IV - Sundara-Kāṇḍa: (Heart of the Ramayana)(1hr)

And Yuddha-Kāṇḍa: (The most popular part of the Ramayana)(1hr)

UNIT V - Ramayana and Modern-day learning(2 hrs)

UNIT VI - Ecological Awareness in the Ramayana(2hrs)

UNIT VII - Different Ramayana: (Epic that connects the world)(1hr)

UNIT VII- Uttara-Kāṇḍa: (An attempt to explain the untold stories)(2hr)

TEXTBOOKS:

1. C. Rajagopalachari. Ramayana. Bharatiya Vidya Bhavan., 34th edn. 2001

REFERENCE BOOK

2. Valmiki. Srimad Valmiki Ramayan English, Gita Press. Gorakhpur. 2020

**Latest edition of the text books & reference books can be referred*

SEMESTER-V

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Medicinal Chemistry –II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP501T**

SCOPE: Medicinal Chemistry II applies the principles and techniques of chemistry to identify, design, and optimize compounds that can be used as drugs for the treatment of various diseases. The course emphasizes on structure-activity relationships of drugs, and the chemical synthesis of important drugs in each class.

This course's importance lies in the process of design and development which results in the formation of new synthetic drug compounds. It also works towards improving the whole system that is used to develop the pharmaceuticals. It aims at making new discoveries in drugs and medicines to treat various ailments. Overall, the course Medicinal chemistry-II makes the students understand the basics of drug discovery. The course Medicinal Chemistry II equips students with the necessary knowledge and skills to contribute effectively to the pharmaceutical industry and adhere to regulatory standards

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to

KNOWLEDGE

K1: Classify medicinal compounds according to their chemical structure

K2: Sketch the synthesis of therapeutic useful drug molecules using available synthetic pathways.

K3: Illustrate the structure-activity relationship of some important drug classes with respect to their biological activity

K4: Relate the chemical structure of drugs with the physicochemical properties

K5: Correlate the mechanism of action and therapeutic value of drugs

K6: Apply principles of organic chemistry for the synthesis /analysis of medicinally important compounds or intermediates required for the synthesis of drugs and their purification

SKILL

S1: Demonstrate the synthetic pathway of new therapeutic agents

S2: Analyse the effects of various functional groups in the therapeutic activity of drugs

S3: Determine the drug targets and their therapeutic potential with respect to drug development
S4 Illustrate the structures and reactions using drug design software
S5: Apply theoretical knowledge to modify the structure-activity relationship of different classes of drugs
S6: Identify basic laboratory skills and techniques required for the synthesis and purity of medicinal compounds

ATTITUDE

A1: Demonstrate a commitment to continuous learning and staying updated with advancements in the field of medicinal chemistry

A2: Motivate your fellow beings to be good team players

A3: Participate in group discussions to plan effectively

A4: Follow a professional and ethical approach

A5: Exhibit good communication skills to emerge as compassionate pharmacy professionals.

A6: Appreciate self-motivation and the ability to engage in self-directed learning.

COURSE CONTENTS

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure-activity relationship of the selective class of drugs as specified in the course, and synthesis of drugs superscripted by (*)

UNIT I **5 Hours**

Antihistaminic agents

Histamine, receptors and their distribution in the human body

H_1–antagonists: Aminoalkyl ethers: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine succinate, Diphenylpyraline hydrochloride Clemastine fumarate

Ethylene diamines: Piperazine derivatives: Chlorcyclizine hydrochloride, Meclizine hydrochloride (1 hr)

Propylamine derivatives: Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartrate (1 hr)

Phenothiazine derivatives: Promethazine hydrochloride*, Trimeprazine tartrate Cyproheptadine hydrochloride, Dibenzocycloheptenes: Azatidine maleate (1 hr)

Second-generation antihistamines: Loratadine, Cetirizine, Levocetirizine, Bilastine,

Mast cell stabilizers: Cromolyn sodium (1 hr)

H_2-antagonists: Famotidine

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

(1 hr)

UNIT II **4 Hours**

Anti-neoplastic agents

Alkylating agents: Mechlorethamine, Cyclophosphamide,

Melphalan, Chlorambucil, Busulfan, Thiotepa, Carmustine, Lomustine (1 hr)

Antimetabolites**:** Mercaptopurine, Thioguanine, Fluorouracil,

Floxuridine,Cytarabine, Methotrexate, Azathioprine (1 hr)

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin (1 hr)

Plant products: Vincristine sulfate, Vinblastin sulfate, Etoposide

Miscellaneous: Cisplatin, Mitotane, Hydroxyurea,(1 hr)

UNIT III

Cardiovascular drugs **10 Hours**

Anti-anginal drugs:Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole**.**(1 hr)

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. **(**1 hr)

Diuretics: Carbonic anhydrase inhibitors: Acetazolamide, Methazolamide, Dichlorphenamide

Thiazides: Chlorthiazide, Hydrochlorothiazide, Hydroflumethiazide,Cyclothiazide

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium-sparing diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol (2 hrs)

Anti-hypertensive Agents: Timolol, Captopril

Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride

Methyldopate hydrochloride*, Clonidine hydrochloride, Guanethidine mono sulfate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride (2 hrs)

Antiarrhythmic Drugs: Quinidine sulfate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol **(**1 hr)

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholestyramine, and Colestipol.(1hr)

Coagulants & Anticoagulants: Vit K, Menadione, Acetomenadione, Warfarin*, Dicoumarol,

Anisindione, Clopidogrel (1hr)

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide

Miscellaneous Drugs: Bosentan, Tezosentan (1 hr)

UNIT IV **7 Hours**

Drugs acting on the Endocrine system

Nomenclature, Stereochemistry, and Metabolism of Steroids (1 hr)

Sex hormones: Testosterone, Nandralone,Progestrones,Oestriol,Oestradiol,Oestrione, Diethyl stilbestrol

Drugs for erectile dysfunction: Sildenafil, Tadalafil (1 hr)

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrel (1 hr)

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone (1 hr)

Thyroid, and anti-thyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole, Carbimazole (1 hr)

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin,Phenformin

Thiazolidinediones: Pioglitazone

Meglitinides: Repaglinide, Nateglinide.

α-Glucosidase inhibitors: Acarbose, Voglibose. (2 hrs)

UNIT V **4 Hours**

General Anaesthetics

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Dissociative anesthetics: Ketamine hydrochloride*

Ultra short-acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.(2 hrs)

Local Anaesthetics:

SAR of local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Piperocaine, Meprylcaine, Cyclomethicaine

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*

Butacaine,Tetracaine,Propoxycaine, Benoxinate(1hr)

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine

Miscellaneous: Phenacaine, Diperodone, Dibucaine. (1hr)

TEXTBOOKS:

1. Williams D.A. Foye's Principles of Medicinal Chemistry,8th edn. LPPWW Publishers, Philadelphia, 2020.
2. Ilango K, Valentina P. Text Book of Medicinal Chemistry, Vol. I & II.2nd edn, Keerthi Publishers, Chennai, 2015.
3. Sriram D, Yogeeswari P. Medicinal Chemistry, 2nd edn, Dorling Kindersley(India) Pvt Ltd, Noida, 2010.

REFERENCE BOOKS:

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th edn, Lippincott Williams & Wilkins., New Delhi; 2010.
2. Chackalamannil S., Rotella D.P, Ward S.E. Comprehensive medicinal chemistry, 3rd edn, Elsevier., Netherlands, 2017.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Biotechnology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP502T**

SCOPE: Pharmaceutical biotechnology encompasses a wide scope that combines knowledge and techniques from various disciplines. It involves the study and application of immunology, recombinant DNA technology, monoclonal antibodies (Mab), formulation of protein drugs, fermentation process, enzyme immobilization, and molecular biology techniques.

Immunology plays a crucial role in understanding the immune system and enables the development of immunotherapeutic approaches and the design of vaccines to prevent and treat diseases. Recombinant DNA technology allows for the manipulation and modification of genetic material to produce desired proteins or therapeutic agents. It facilitates the production of recombinant proteins, which has revolutionized the field of diagnostics and targeted therapeutics. Molecular biology techniques play a vital role in pharmaceutical biotechnology. Formulation of protein drugs focuses on developing efficient and stable formulations of these therapeutic proteins. Fermentation processes are utilized for large-scale production of pharmaceuticals. Enzyme immobilization techniques provide a means to enhance the stability and reusability of enzymes used in pharmaceutical processes and for various applications like biosensors.

This course will develop an attitude of critical thinking and problem-solving among students. Students will exhibit a proactive approach to learning and staying updated with the latest advancements in the field. Overall, the scope of pharmaceutical biotechnology contributes to the potential to improve healthcare outcomes and address unmet medical needs.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course the student shall be able to

KNOWLEDGE:

K1: Acquire comprehensive knowledge about the fundamental concepts, principles, and terminology related to biotechnology.

K2: Explain the principles and techniques involved in the production and characterization of monoclonal antibodies (Mabs) and their role in diagnostics and therapeutics.

K3: Describe the formulation and development of protein drugs, including the different strategies for enhancing their stability, bioavailability, and targeted delivery.

K4: Develop a strong understanding of fermentation processes and their significance in the production of pharmaceuticals, including the optimization of growth conditions and scale-up strategies.

K5: Explain the principles and applications of enzyme immobilization techniques in pharmaceutical biotechnology, including the design of Biosensors.

K6: Acquire knowledge of various molecular biology techniques used in pharmaceutical biotechnology, such as DNA cloning, PCR, Blotting techniques and ELISA.

K7: Explain the function of the immune system, including the different components including different types of vaccines and their role in preventing infectious diseases.

SKILL:

S1: Develop the ability to critically evaluate the principles and applications of recombinant DNA technology.

S2: Apply the theoretical principles of immunology in the development of immunotherapeutics and diagnostics.

S3: Identify issues in the formulation and development of protein drugs in terms of stability and efficacy.

S4: Apply the principles of fermentation processes in the production of pharmaceuticals, including the optimization of growth conditions.

S5: Demonstrate an understanding of enzyme immobilization techniques and their applications in pharmaceutical biotechnology.

S6: Critically analyze various molecular biology techniques used in pharmaceutical biotechnology.

ATTITUDE

A1: Develop an attitude of critical thinking and problem-solving

A2: Exhibit self-motivation, curiosity, and a proactive approach to learning and staying updated with the latest advancements.

A3: Demonstrate professional behavior, including punctuality, respect for others, effective time management, and adherence to professional standards and guidelines.

A4: Develop an attitude of adaptability and willingness to learn new techniques and technologies in the rapidly evolving field of pharmaceutical biotechnology.

A5: Cultivate an attitude of continuous improvement by staying updated.

A6: Display openness to new ideas, alternative viewpoints, and adaptability to change.

COURSE CONTENT:

UNIT I **5Hours**

Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. (1h.)

Enzyme Biotechnology- Methods of enzyme immobilization and applications. (3hrs.)

Biosensors- Working and applications of biosensors in Pharmaceutical Industries. (1h.)

UNIT II **8 Hours**

Basic principles of genetic engineering. (1h.)

Study of cloning vectors, restriction endonucleases and DNA ligase. (2 hrs.)

Recombinant DNA technology. Application of genetic engineering in medicine. (1h.)

Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. (1h.)

Immuno blotting techniques- ELISA, Western blotting, Southern blotting. (2hrs.)

Brief introduction to PCR

Mutation: Types of mutation/mutants. (1h.)

UNIT III **9 Hours**

Types of immunity- humoral immunity, cellular immunity. a) Structure of Immunoglobulins (2hrs.)

Hypersensitivity reactions. (1h.)

General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. (2hrs)

(Storage conditions and stability of official vaccines) (1h.)

Hybridoma technology- Production, Purification and Applications (1h.)

Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma substitutes. (2hrs.)

UNIT IV **4 Hours**

Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. (2hrs)

Large scale production fermenter design and its various controls. (1h.)

Study of the production of - Penicillin, citric acid, Vitamin B12, Glutamic acid. (1h.)

UNIT V **4 Hours**

Points to consider in the process of formulating a therapeutic protein and how it differs from the formulation of small molecules. (2hrs)

Protein structure, protein stability and characterization. (1h.)

Formulation development, excipients used and freeze-drying of proteins. (1h.)

TEXT BOOKS:

1. Crommelin DJA, Sindelar RD, Meibohm B. Pharmaceutical Biotechnology: Fundamentals and Applications, 5th edn, Springer Nature Switzerland AG, 2019.
2. Satyanarayana U. Biotechnology. 1st edn, Books & Allied Ltd, 2020.

REFERENCE BOOKS:

1. Goldsby RA, Kindt TJ, Osborne BA, Kuby J, Goldshy RA, Kuby Immunology. 4th edn, W.H. Freeman, New York, 2000.
2. Glick BR and Pasternak JJ. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 4th edn, ASM Press Washington D.C. 2010.
3. Stanbury FP, Whitakar A, and Hall JS. Principles of fermentation technology, 2nd edn, Aditya books Ltd., New Delhi, 2017.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacology-II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP503T**
Pharmacology-II (P)	**2**	**0**	**0**	**30**	**1**	**V**	**BP508P**

SCOPE: The course aims to comprehend the science behind drugs and how they interact with the human body. Knowledge of pharmacology can contribute to the development of new medications by studying the effects of drugs on cells, tissues, and organisms. It helps to explore potential therapeutic targets, design and synthesize new compounds, and assess their safety and efficacy. It provides knowledge of drug-receptor interactions, signal transduction pathways, and the impact of drugs on physiological processes to understand their mechanisms of action.

The course offers insights into how drugs are processed by the body, including factors such as bioavailability, drug clearance, and drug-drug interactions. It delivers the safety of medications, identifies potential side effects, and determines appropriate dosage regimens to minimize adverse reactions. Besides, it imparts a better understanding of drug response variability among individuals, pharmacogenetics, and drug interactions, and guides dose and drug selection. Additionally, it helps in pursuing careers in academia, conducting research to expand knowledge in pharmacology, and teaching future scientists and healthcare professionals.

COURSE LEARNING OUTCOMES

Upon the successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: List the different classes of clinically relevant drugs used for various diseases/disorders affecting cardiovascular, respiratory, renal, and endocrine systems

K2: Illustrate the mechanistic role of drugs used for various diseases/disorders affecting cardiovascular, respiratory, renal, and endocrine systems

K3: Discuss the pharmacological actions of drugs at organ system/sub-cellular/ macromolecular levels, pharmacokinetics, and dose of drugs used in the treatment of various diseases/disorders

K4: Predict the mechanism of drugs that contributes to adverse drug reactions and contraindications

K5: Distinguish the effect of various drugs on receptors using isolated tissue preparations

K6: Correlate the knowledge in pharmacology with related medical sciences.

SKILL

S1: Justify the relevance of drugs in the pharmacological management of various disorders

S2: Predict the drug interactions in a given prescription

S3: Recommend the possible alternatives to the drug therapy

S4: Identify the signs and symptoms of drug poisoning

S5: Operate different lab equipment according to SOPs for preclinical experimentation.
S6: Perform skilfully various bioassay experiments in different tissues

ATTITUDE

A1: Appreciate the knowledge of Pharmacology for learning pharmacotherapy and toxicology.
A2: Communicate with everyone effectively.
A3: Support and collaborate with others.
A4: Exhibit professionalism in the work environment.
A5: Participate actively in healthcare initiatives.
A6: Embrace the new advancements in the healthcare system.

COURSE CONTENTS

UNIT I **7 Hours**

Pharmacology of drugs acting on the CVS

Diuretics & Anti-diuretics (2hrs)
Drugs used in congestive heart failure (1hr)
Anti-hypertensives (1hr)
Anti-anginals (1hr)
Anti-arrhythmic drugs (2hr)
Hypolipidemics (1hr)

UNIT II **5 Hours**

Pharmacology of drugs acting on the blood system

Drug used in the therapy of shock (1hr)
Hematinics, coagulants, and anticoagulants (2hrs)
Fibrinolytics and anti-platelet drugs (1hr)
Plasma volume expanders (1hr)

UNIT III **5 Hours**

Autacoids and related drugs

Antihistamines, 5-HT antagonists (2hrs)
Non-steroidal anti-inflammatory agents (1hr)
Anti-gout drugs (1hr)
Anti-rheumatic drugs emphasis on DMARDs (1hr)

UNIT IV **7 Hours**

Pharmacology of drugs acting on the endocrine system

Anterior Pituitary hormones analogues and their antagonists (1hr)
Thyroid hormones analogues and their antagonists (1hr)
Parathormone, Calcitonin and Vitamin D (1hr)
Insulin, Oral hypoglycaemic (2hrs)
Corticotropin, Corticosteroids (1hr)

UNIT IV **6 Hours**

Pharmacology of drugs acting on the endocrine system

Androgens (1hr)
Anabolic steroids (1hr)
Estrogens and progesterone (2hrs)

Oral contraceptives and Tocolytics (1hr)
Discuss novel drugs approved by FDA/CDSCO and novel drug targets for treating various diseases/disorders (1hr)

LIST OF EXPERIMENTS:

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Demonstrate the effect of drugs on the blood pressure and heart rate of the dog.
3. Demonstrate the effect of diuretics in rats/mice
4. Demonstrate DRC of acetylcholine using chicken ileum
5. Demonstrate the anti-ulcer activity of a drug using the pylorus ligand (SHAY) rat model and NSAIDS-induced ulcer model.
6. Demonstrate test for pyrogens in rabbit
7. Evaluate the effect of atropine on the DRC of acetylcholine using chicken ileum
8. Evaluate the effect of neostigmine on the DRC of acetylcholine using chicken ileum
9. Determine the unknown concentration of acetylcholine by the matching bioassay method using chicken ileum.
10. Determine the unknown concentration of acetylcholine by the interpolation bioassay method using chicken ileum.
11. Estimation of liver function test using the semi-auto analyser
12. Estimation of kidney function test using the semi-auto analyser
13. Estimation of blood urea nitrogen using the semi-auto analyser
14. Estimation of total protein using the semi-auto analyser
15. Estimation of various lipid profiles using the semi-auto analyser

TEXTBOOKS

1. Kharen W. Lippincott Illustrated Reviews: Pharmacology. 8th edn. Wolters Kluwer (Inidia) Pvt. Ltd. 2022.
2. Tripathi KD. Essentials of medical pharmacology. 8th edn. Jaypee: Delhi. 2018.
3. Ghosh MN. Fundamentals of Experimental Pharmacology. 7th edn. India: Hilton & Company; 2019. (Practical)

REFERENCE BOOKS

1. Laurence LB, Randa HD, Björn CK. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 13th edn, McGraw Hill: New York. 2017.
2. James R, Rod F, Graeme H, Yoon KL, David, Humphrey R. Rang & Dale's Pharmacology. 9th edn. Churchill Living stone: Edinburgh Elsevier. 2020.
3. Katzung BG, Kruidering HM, Trevor AJ. Basic & Clinical Pharmacology.15th edn, McGraw-Hill Education: New York. 2019.
4. Satoskar RS, Bhandarkar SD, Nirmala N. Pharmacology and Pharmacotherapeutics. 26th edn. Popular Prakashan; 2020

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Herbal Drug Technology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP504T**
Herbal Drug Technology(P)	**2**	**0**	**0**	**30**	**1**	**V**	**BP509P**

SCOPE: This course gives the basic understanding of the raw material and excipient used in herbal drug industry, and the guidelines for the quality control of herbal drugs.The course includes an overview of the regulatory framework and guidelines governing the manufacture, and marketing of herbal drugs. Students gain insights into national and international regulations related to herbal drug products. The course also emphasizes on good manufacturing practices (GMP), patenting of Ayurveda, Siddha, Unani drugs.

Furthermore, it explores the scope, regulatory aspects and potential of nutraceuticals in promoting health and preventing diseases. The scope extends to understanding the general concept of interactions between herbal drugs and conventional drugs, as well as interactions between herbs and food. Herbal Drug Technology encompasses knowledge and skills that enable students to make contributions to the herbal industry. Students should demonstrate the ability of responsible decision-making.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, a student shall be able to;

KNOWLEDGE

K1: Summarize the herbal raw material as source of herbal drugs.

K2: Describe the WHO guidelines for evaluation of herbal drugs

K3: Discuss good manufacturing practice of Indian Systems of Medicine.

K4: Explain the patenting and regulatory requirements of herbal products.

K5: Analyze the possible side effects and interactions of herbal drugs.

K6: Analyze the case study of curcuma and Neem.

K7: Compare the basic principles of Indian systems of medicines.

SKILL

S1: Identify the phytoconstituents present in the crude drugs.
S2: Analyze the crude drug for the content of active phytoconstituents.
S3: Evaluate the prepared herbal and Ayurvedic formulation as per Pharmacopoeial requirements.
S4: Demonstrate the preparation of herbal formulations.
S5: Analyze the purity of the sample by comparing with standard values.
S6: Prepare and evaluate herbal cream.

ATTITUDE

A1: Work ethically.

A2: Accept the diverse perspectives, ideas, and cultures.

A3: Demonstrate the ability of responsible decision-making.

A4: Engage in initiatives that promote positive social changes.

A5: Foster an open-minded attitude.

A6: Complete the tasks on time individually or in a team.

COURSE CONTENTS

UNIT I **8 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation,

Source of Herbs (1 hr)

Selection, identification and authentication of herbal materials

Processing of herbal raw material(2 hrs)

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha,Unani and Homeopathy (2 hrs)

b) Preparation and standardization of Ayurvedic formulations vizAristas and Asawas,

Ghutika,Churna, Lehya and Bhasma.(1 hr)

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.(1 hr)

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.(1 hr)

UNIT II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. (1 hr)

Healthbenefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.(2 hrs)

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina (2 hrs)

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper &Ephedra.(2 hrs)

UNIT III **6 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.(3hrs)

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors &perfumes.(2 hrs)

Herbal formulations:

Novel drug delivery system for herbal drugs: Phytosomes, Ethosomes, Transferosomals(1hr)

UNIT IV **5 Hours**

Evaluation of Drugs WHO guidelines for the assessment of herbal drugs(1hr)

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy.(1hr)

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of CurcumaandNeem)(1hr)

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.(2 hrs)

UNIT V **4 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.(1hr)

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. (1hr)

Schedule T – GoodManufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records. (2 hrs)

LIST OF EXPERIMENTS:

1. Perform the preliminary phytochemical screening of crude drugs.
2. Determine the alcohol content of Asava and Arista
3. Preparestandardized extract for cosmetic formulations like creams, lotions and shampoos and their evaluation.
4. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
5. Monograph analysis of herbal drugs from recent Pharmacopoeias
6. Determination of Aldehyde content in lemon oil
7. Estimation of total Phenolic content
8. Determination of total alkaloids
9. Determination of acid value of the fixed oil sample.

TEXT BOOKS

1. Mangathayaru K. PharmacognosyAn Indian Perspective, 1st edn. Dorling Kindersley Pvt. Ltd. New Delhi, India: 2013.
2. Goldberg I. Functional foods. 1st edn. Springer Science+ business media. 2019.
3. Rangari VD. Pharmacognosy and Phytochemistry.Vol. I & II, 3rd edn. Career Publications; Nashik: 2017.

REFERENCE BOOKS

1. Mukherjee PK. Quality control of Drugs: An Approach to Evaluation of Botanicals.1st edn. Business Horizons Publishers; New Delhi, India: 2002.
2. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization. Geneva (Latest)
3. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. Geneva: World Health Organization; 2004.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Industrial Pharmacy I (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP505T**
Industrial Pharmacy I (P)	**3**	**0**	**0**	**30**	**1.5**	**V**	**BP510P**

SCOPE: The course enables the student to understand and appreciate end-to-end drug product development in a pharmaceutical industry. Industrial Pharmacy encompasses the study of preformulation and formulation of solid, liquid, and semisolid dosage forms, as well as the selection and evaluation of packaging materials and the production of aerosols. It provides students with a comprehensive understanding of the principles, techniques involved in the development, manufacturing, packaging and quality control of pharmaceutical products. Students will gain knowledge of the physicochemical properties of drugs and excipients, and learn the skills to design stable and effective dosage forms. Students will also explore various packaging materials and their role in maintaining product integrity.

They will learn professional and ethical approaches towards the manufacturing, quality control, and packaging of pharmaceutical products and recognize its importance to ensure the efficacy, safety, and stability of pharmaceutical products. The scope of Industrial Pharmacy equips students with the necessary knowledge and skills to contribute effectively to the pharmaceutical industry and adhere to regulatory standards.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course the student shall be able to;

KNOWLEDGE

K1: Demonstrate comprehensive knowledge of the principles and concepts related to preformulation and formulation of solid, liquid, and semisolid dosage forms.

K2: Explain the different types of packaging materials used in the pharmaceutical industry and their role in maintaining product integrity and stability.

K3: Analyze the principles and techniques involved in the formulation and production of aerosol dosage forms.

K4: Compare and contrast the physicochemical properties of different pharmaceutical dosage forms and their implications on product development.

K5: Evaluate the various equipments methods and approaches employed in the manufacturing of pharmaceutical formulations.

K6: Demonstrate a comprehensive understanding of the principles and procedures involved in quality control testing of pharmaceutical products.

SKILL

S1: Apply theoretical knowledge to design and develop stable and effective solid, liquid, and semisolid dosage forms.

S2: Demonstrate proficiency in performing preformulation studies, including physicochemical characterization of drug substances and excipients.

S3: Conduct experiments and analyze data to assess the quality of pharmaceutical products.

S4: Apply standard operating procedures (SOPs) and good laboratory practices (GLP) while performing experiments and handling equipment in the industrial pharmacy laboratory.

S5: Develop skills in the formulation and compounding of different types of dosage forms, including tablets, capsules, injections and eye drops.

S6: Acquire hands-on experience in using pharmaceutical manufacturing equipment.

ATTITUDE

A1: Display a professional and ethical approach towards the development, manufacturing, and packaging of pharmaceutical products.

A2: Demonstrate a commitment to continuous learning and staying updated with advancements.

A3: Recognize the importance of quality control in ensuring the safety, efficacy, and compliance of pharmaceutical products.

A4: Show an appreciation for the interdisciplinary nature of industrial pharmacy and the significance of effective collaboration and communication.

A5: Develop a sense of responsibility and accountability towards ensuring the quality of pharmaceutical formulations and packaging.

A6: Embrace a problem-solving mindset as a team and a willingness to explore innovative approaches in addressing challenges related to pharmaceutical formulations.

COURSE CONTENTS

UNIT I **4 Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. (1 hr)

Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism, intrinsic dissolution.

Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization.(1 hr.)

Biopharmaceutical properties: Solubility, permeability and BCS classification. (1 hr)

Drug-excipient interaction.

Application of preformulation considerations in the development of dosage forms. (1 hr)

UNIT II **7 Hours**

Oral solid doasage forms-Tablets:

Introduction, ideal characteristics of tablets, classification of tablets. Excipients,Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. (3 hrs)

Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. (3 hrs)

Quality control tests: In process and finished product tests (1 hr)

UNIT III **5 Hours**

Oral solid doasage forms-Capsules:

Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. (3 hrs)

Soft gelatin capsules: Nature of shell and capsule content, size ofcapsules,importance of base adsorption and minim/gram factors, production, inprocess and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. (2 hrs)

UNIT IV **7 Hours**

Parenteral Products:

Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity. (2 hrs)

Production procedure, production facilities and controls, aseptic processing. (1 hr)

Formulation of injections, sterile powders, large volume parenterals and lyophilized products. (1 hr)

Quality control tests of parenteral products. (1 hr)

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eyedrops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations (2 hr)

UNIT V **7 Hours**

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; evaluation of aerosols; Quality control. (3 hrs)

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers. (2 hr)

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. (2 hrs)

LIST OF EXPERIMENTS:

1. Preformulation studies on paracetamol/aspirin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Quality control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)
12. Preparation of suppositories
    a) Glycerogelatin suppository
    b) Cocabutter suppository
    c) Zinc Oxide suppository

TEXT BOOKS:

1. Khar RK, Vyas SP, Ahmad FJ, Jain GK. Theory and Practice of Industrial Pharmacy by Liberman& Lachman, 4th edn,CBS Publishers 2021.
2. Kevin MG, Taylor Aulton ME. Pharmaceutics- The Design and Manufacture of Medicines, 6th edn, Elsevier, 2021.

REFERENCE BOOKS:

1. Adejare A (Editor) Remington: The Science and Practice of Pharmacy, 23rd edn, Elsevier, 2020.
2. Florence AT, Siepmann J. Modern Pharmaceutics, Vol 1&2, 5th edn, Marcel Dekker Inc, New York, 2009.
3. Ansel HC. Introduction to Pharmaceutical Dosage Forms by, Lea & Febiger, Philadelphia, 5thedn, 2005

ADDITIONAL READINGS:

1. Liberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms - Tablets, Vol 1 -3, 2nd edn, Marcel Dekker Series, 1989.

2. Kenneth EA, Liberman, Lachman L. Pharmaceutical dosage form - Parenteral medication Vol 1&2, 2nd edn, Marcel Dekker Series, 1993.

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacy Practice (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP506T**

SCOPE: The course of Pharmacy Practice encompasses a broad range of knowledge and skills related to the practice of pharmacy and the provision of pharmaceutical care. It involves the study of principles, guidelines, and standards for the effective and safe use of medications, as well as the responsibilities of pharmacists in various healthcare settings. Some key aspects within the scope of Pharmacy Practice: Medication Dispensing and Management: Pharmacy Practice covers the proper dispensing and management of medications, including dosage calculations, prescription interpretation, medication preparation, labelling, and storage. Patient Counselling and Education: Pharmacists play a crucial role in providing patient counselling and education on medication use, including dosage instructions, potential side effects, drug interactions, and adherence to treatment regimens. Pharmaceutical Care: Pharmacy Practice emphasizes the provision of patient-centred pharmaceutical care, which involves assessing patients' medication-related needs, identifying and resolving medication therapy problems, and monitoring therapeutic outcomes. Medication Safety and Quality Assurance:

This aspect focuses on ensuring medication safety, preventing medication errors, and promoting quality assurance in the pharmacy setting. It includes medication error reporting, medication reconciliation, and adherence to medication safety protocols. Pharmacotherapy and Clinical Pharmacy: Pharmacy Practice involves the study of pharmacotherapy, which includes understanding the principles of drug action, pharmacokinetics, pharmacodynamics, and the rational use of medications in the treatment and management of various diseases and conditions and involves patient care. Pharmacy Practice is a multidisciplinary field that requires a strong foundation in pharmaceutical sciences, patient care, and professional skills. It prepares pharmacists to work in diverse settings, including community pharmacies, hospitals, clinics, research institutions with a focus on optimizing patient outcomes and promoting safe and effective medication use.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Discuss Adverse Drug Reaction (ADR) and its management
K2: Describe the structure of Hospital Formulary
K3: Outline the roles and responsibilities of Pharmacy and Therapeutic Committee
K4: Illustrate the Hospital Pharmacy budget preparation and its implementation.
K5: Explain the management of a drug store in a hospital
K6: Interpret the Clinical laboratory data in diagnosing diseases

SKILL

S1: Detect different types of Adverse drug reactions and reporting
S2: Demonstrate the drug distribution system in hospital
S3: Differentiate prescribed and non-prescription drugs
S4: Evaluate the role of clinical pharmacy services in hospital
S5: Demonstrate the management of drug store
S6: Explain role of Pharmacist in overcoming Antimicrobial resistance (AMR)

ATTITUDE

A1: Participate in ward rounds to detect adverse drug reaction and reporting
A2: Follow the patients till completion of the treatment
A3: Determine the role of pharmacist in connection between prescribers and patients
A4: Distinguish the role of pharmacist with other health care professionals
A5: Evaluate the ASHP guidelines for the use of investigational drugs
A6: Establish the role of Pharmacist in handling Antibiotic resistance

COURSE CONTENTS

UNIT I **5 Hours**

Adverse drug reaction Classifications

Adverse drug reaction reporting and management

Allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs(1 hr)

Spontaneous case reports and record linkage studies (1 hr)

Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, Drug food /Herb interactions. Examples and mechanisms. Drugs (1 hr)

Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy(1 hr)

Hospital and its organization: Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions. (1 hr)

UNIT II **5 Hours**

Drug distribution system in Hospital

ASHP guidelines for Hospital drug distribution system

Drug distribution system in a hospital Dispensing of drugs to inpatients, types of drug distribution systems

Charging policy and labelling, dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs. (1 hr)

Hospital formulary Definition, contents of hospital formulary

Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. (1 hr)

Medication Adherence

Medication adherence Causes of medication non-adherence

Pharmacist role in the medication adherence, and monitoring of patient medication adherence.(1 hr)

Hospital pharmacy and its organization: Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.(1 hr)

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information Drug information services (1 hr)

UNIT III **6 Hours**

Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary

Inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation. (1 hr)

Patient counselling

Patient counselling: What, Whom, When, How, Where. Counselling on Non-Prescription drugs.(1 hr)

Prescribed medication order and communication skills

Prescribed medication order. Prescribed medication order- interpretation and legal requirements and Communication skills- communication with prescribers and patients. (1hr)

Community Pharmacy:

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store (1 hr)

Dispensing of proprietary products, maintenance of records of retail and wholesale drug store. Patient medication history interview Need for the patient medication history interview, medication interview forms**.** (1 hr)

Patient counselling Definition of patient counselling; steps involved in patient counselling, and Special cases that require the pharmacist, Community pharmacy management Financial, materials, staff, and infrastructure requirements. (1 hr)

UNIT IV **5 Hours**

Budget preparation

Budget preparation and implementation. (1 hr)

Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist

Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care (1 hr)

Therapeutic drug monitoring Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring. (1 hr)

Indian scenario for Therapeutic Drug Monitor. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. (1 hr)

Education and training program in the hospital Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education (1 hr)

UNIT V **6 Hours**

Drug store management

Drug store management and inventory control Organisation of drug store. (1 hr)

Types of materials stocked and storage conditions(1 hr)

Purchase and inventory control: principles, purchase procedure, purchase order(1 hr)

Procurement and stocking, Economic order quantity, Reorder quantity level (1 hr)

Methods used for the analysis of the drug expenditure

Investigational use of drugs- ASHP guidelines for the use of Investigational drugs in institutions.

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee(1 hr)

Over the counter (OTC) sales Introduction and sale of over the counter, and Rational use of common over the counter medications (1hr)

UNIT VI **3 Hours**

Interpretation of Clinical Laboratory Tests

Blood chemistry, haematology, and urinalysis(1hr)

Antimicrobial resistance

Definition of antimicrobial resistance, Overview of resistance mechanisms, Basics of resistance mechanisms with examples of antimicrobials, AMR surveillance system(1hr)

Overview on the need for AMR surveillance, recent updated AMR surveillance report, Causes and consequences of AMR, Strategies to combat AMR ,Role of pharmacists in overcoming AMR (1hr)

TEXT BOOKS :

1. Merchant S.H. and Quadry J S A textbook of hospital pharmacy, 14th edn. Ahmedabad: B.S. Shah Prakakshan; 2019.
2. Parthasarathi G, Karin N H, Milap C N. A textbook of Clinical Pharmacy Practice-essential concepts and skills, 2nd edn. Orient Longman Private Limited; Chennai: 2012.
3. K.G.Revikumar. A textbook of Pharmacy Practice.2nd edn. Career publications; Maharashtra: 2019.

REFERENCE BOOKS:

1. William E. H. Hospital pharmacy, 5th edn. Lea & Febiger; Philadelphia: 1986.
2. Mary Lee. Basic skills in interpreting laboratory data, 4th edn. American Society of Health System Pharmacists Inc; Bethesda: 2009.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Life Skills I (T)	**2**	**0.5**	**0**	**30**	**2.5**	**V**	**BP507T**

SCOPE: Life Skills training envisages to equip students with essential skills to conduct and perform better in their personal and professional life. Life Skills I is the first level course for the UG students, and it consists of three components namely Soft Skills, Aptitude Skills, and Verbal Skills. The topics covered include communication skill, listening skill, self-confidence, professionalism, emotional intelligence, numbers, percentage, ratio & proportion, averages, data interpretation, data sufficiency, vocabulary, grammar, reasoning and speaking.

COURSE LEARNING OUTCOMES:

CO1: Soft Skills - To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.
CO2: Soft Skills - To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
CO3: Aptitude – To analyse, understand and solve questions in arithmetic and algebra by employing the most suitable methods.
CO4: Aptitude - To investigate and apply suitable techniques to solve questions on data analysis.
CO5: Verbal – To infer the meaning of words & use them in the right context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.
CO6: Verbal - To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

Skills: Communication, self-confidence, emotional intelligence, presentation and problem-solving.

COURSE CONTENTS

SOFT SKILLS **15**

Introduction to Soft Skills 1

Soft skills and its necessity in the modern age, significance of soft skills in the medical profession, topics to be covered in the soft skills training program.

Communication Skill 2

The process of communication, barriers to communication, verbal communication and non-verbal communication, role of perception in communication.

Listening Skill 1

The concept of listening and its significance in the communication process, the importance of listening skill in the medical profession, different types of listening, how to become an effective listener?

Emotional Intelligence 2

Emotional Intelligence and types of EIs, emotional leadership and how to self-manage and motivate, the process of achieving perseverance, self-control, and skill in getting along with others, EI for working in teams, adjust to change and be flexible.

Self Confidence & **Professionalism** 1

Building self-confidence, role of self confidence in personal and professional effectiveness, role of self confidence in effective communication, how to make an effective formal presentation.

Presentations 1

Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Presentation Practice and Feedback 6

Every student will make an individual (or in a group) formal presentation on a chosen topic. The students will be given feedback for improvement.

Being Proactive 1

The concept of being proactive, the importance of being proactive in life, the stimulus – response model of being proactive – Dr. Stephen R Covey, circle of concern and circle of Influence – Dr. Stephen R Covey, developing proactive language in life.

APTITUDE SKILLS **15**

Numbers 3

Types, power cycles, divisibility, prime, factors & multiples, HCF & LCM, surds, indices, square roots, cube roots, and simplification.

Percentage 5

Basics, profit, loss & discount, and simple & compound interest.

Ratio, Proportion & Variation 3

Basics, allegations, mixtures, and partnership.

Averages 1

Basics, and weighted average.

Data Interpretation 2

Tables, bar diagrams, Venn diagrams, line graphs, pie charts, caselets, mixed varieties, network diagrams and other forms of data representation.

Data Sufficiency 1

Introduction, 5 options data sufficiency and 4 options data sufficiency.

VERBAL SKILLS **15**

Vocabulary 4

Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misspelt words, commonly confused words and wrong form of words in English.

Grammar (Basics) 4

Learn the usage of grammar and facilitate students to identify errors and correct them.

Reasoning 3

Stress the importance of understanding the relationship between words through analogy questions.

Speaking Skills 4

Make students conscious of the relevance of effective communication in today's world through role plays, debates and individual speaking activities.

REFERENCE BOOKS:

1. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & **Co.**
2. The hard truth about Soft Skills, by Amazon Publication.
3. Verbal Skills Activity Book, CIR.
4. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites
9. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
10. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
11. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
12. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
13. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
14. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
15. A Modern Approach to Logical Reasoning, R S Aggarwal.
16. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

SEMESTER-VI

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Medicinal Chemistry–III (T)	**3**	**0.5**	**0**	**45**	**3.5**	**VI**	**BP601T**
Medicinal Chemistry–III (P)	**0**	**0**	**2**	**30**	**1.0**	**VI**	**BP608P**

SCOPE: In continuation to Medicinal Chemistry-I & II, Medicinal Chemistry III applies the principles and techniques of chemistry to identify, design and optimize compounds that can be used as drugs for the treatment of various diseases.

This course is designed to impart fundamental knowledge on the structure, chemistry, and therapeutic use of drugs. The course emphasizes on structure-activity relationships of drugs, the chemical synthesis of important drugs in each class, modern techniques of rational drug design like quantitative structure-activity relationship (QSAR), prodrug concept, combinatorial chemistry, and Computer-aided drug design (CADD). This course's importance lies in the process of design and development which results in the formation of new synthetic drug compounds. It also works towards improving the whole system that is used to develop the pharmaceuticals. It provides individuals with the necessary knowledge and skills for the design and development of new synthetic molecules. It provides a commitment to continuous learning and staying updated with advancements in the field of medicinal chemistry.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Classify medicinal compounds according to their chemical structure
K2: Describe the modern techniques of rational drug design.
K3: Discuss the basic concepts of prodrug design
K4: Explain the methods and applications of combinatorial chemistry
K5: Outline the synthesis of therapeutic useful drug molecules using available synthetic pathways.
K6: Illustrate the structure-activity relationship of some important drug classes with respect to their biological activity

SKILL

S1: Prepare medicinally important compounds and intermediates from available synthetic pathways

S2: Appl**y** the physicochemical methods to characterize the prepared compounds

S3: Calculate the percentage purity of medicinally important compounds by performing assays per pharmacopoeial procedure

S4: Determine the physicochemical properties for a class of drugs course using the drug design software (Swiss ADME) Drug likeliness screening (Lipinski RO5)

S5: Illustrate the structures and reactions using a chem draw/chem sketch

S6: Apply standard operating procedures (SOPs) and Good Laboratory Practices (GLP) while performing experiments.

ATTITUDE

A1: Demonstrate a commitment to continuous learning and staying updated with advancements in the field of medicinal chemistry

A2: Motivate your fellow beings to be good team players

A3: Participate in group discussions to plan effectively

A4: Follow a professional and ethical approach

A5: Exhibit good communication skills to emerge as compassionate pharmacy professionals.

A6: Appreciate self-motivation and the ability to engage in self-directed learning.

COURSE CONTENTS

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure-activity relationship of a selective class of drugs as specified in the course, and synthesis of drugs superscripted by (*)

UNIT I **7 Hours**

Antibiotics

Nomenclature, Stereochemistry, Structure-activity relationship, Chemical degradation classification, and important products of the following classes.

Historical background of Antibiotics, Chemical degradation of penicillin

β-Lactam antibiotics: Penicillin, Cephalosporins,(2 hrs)

β- Lactamase inhibitors,Monobactams (1 hr)

Aminoglycosides: Streptomycin, Neomycin.(1 hr)

Tetracyclines: Tetracyclines, Oxytetracycline, Chlortetracycline, Minocycline (1 hr)

Macrolide: Erythromycin, Clarithromycin, Azithromycin. (1 hr)
Miscellaneous: Chloramphenicol*, Clindamycin, and latest (1 hr)

UNIT II **10 Hours**

Antimalarials: Quinolines: SAR, Hydroxychloroquine,Amodiaquine,Primaquine phosphate, Pamaquine*, Mefloquine (3 hrs)

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. (1 hr)

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone (1 hr)

Etiology of malaria (1 hr)
Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Atovaquone (2 hrs)
Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantel, Ivermectin. (2 hrs)

UNIT III **8 Hours**

Anti-tubercular Agents

Synthetic anti-tubercular agents: Isoniazid*, Ethionamide, Ethambutol,Pyrazinamide, Para aminosalicylic acid.*(2 hrs)

Anti-tubercular antibiotics: Rifampicin, Capreomycin sulfate. Rifabutin, Cycloserine. (2 hrs)
Urinary tract anti-infective agents

Quinolones: SAR of quinolones, Nalidixic acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin (2 hrs)

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. (2 hrs)

UNIT IV **10 Hours**

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.(1 hr)
Synthetic Antifungal agents: Clotrimazole, Econazole, Miconazole*, Ketoconazole, Naftifine hydrochloride, Tolnaftate*. Butoconazole, Oxiconazole, Tioconozole, Itraconazole, Fluconazole, Posaconazole (2 hrs)
Antiviral agents: Amantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Ganciclovir, Zidovudine, Didanosine (1hr)
Rimantadine hydrochloride, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir (1 hr)

Sulphonamides and Sulfones: Chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulphamethizine, Sulfacetamide*, Sulfamethoxazole* (2 hrs)

Historical development of sulphonamides, Sulfisoxazole, Sulfapyridine, Sulphadiazine, Mefenide acetate, and Sulfasalazine (2 hrs)

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone* (1 hr)

UNIT V **10 Hours**

Prodrugs: Basic concepts and application of prodrugs design. (3 hrs)

Introduction to Drug Design

Various approaches are used in drug design. (1 hr)

Physicochemical parameters used in quantitative structure-activity relationships (QSAR) such as partition coefficient, Hammet's electronic parameter, Taft's steric parameter, and Hansch analysis. (2 hrs)

Pharmacophore modeling and docking techniques (2hrs)

Combinatorial Chemistry**:** Concept and applications chemistry: Solid phase and solution phase synthesis (2 hrs)

LIST OF EXPERIMENTS:

I. Preparation of drugs and intermediates

1. Preparation of 7-Hydroxy, 4-methyl coumarin by Pechmann reaction
2. Preparation of 2,3-diphenyl quinoxaline
3. Preparation of 2,4,5-Triphenyl imidazole
4. Preparation of Benzimidazole
5. Preparation of Benzocaine

II. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique. (2 or 3 experiments)

III. Determination of partition coefficient and pka of any two drugs

IV. Drawing structures and reactions using chem draw®

V. Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors, and acceptors for the class of drugs course content using drug design software (Swiss ADME) Drug likeliness screening (Lipinski RO5)

TEXTBOOKS:

1. Williams D.A. Foye's Principles of Medicinal Chemistry,8th edn. LPPWW Publishers: Philadelphia; 2020
2. Ilango K, Valentina P. Text Book of Medicinal Chemistry, Vol. I & II.2nd edn. Keerthi Publishers: Chennai; 2015

REFERENCE BOOKS:

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th edn. Lippincott Williams & Wilkins: New Delhi; 2010
2. Furniss, and Arthur I. Vogel. Vogel's Textbook of Practical Organic Chemistry,5th.edn Longman Scientific & Technical; London: 2009(Practical)
3. Chackalamannil S., Rotella D.P, Ward S.E. Comprehensive medicinal chemistry, 3rd edn Elsevier: Netherlands, 2017

ADDITIONAL READING MATERIALS:

Indian Pharmacopoeia, Vol 1, 2022

JOURNALS:

Journal of Medicinal Chemistry
European Journal of Medicinal Chemistry
ACS Medicinal Chemistry letters

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacology-III(T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP602T**
Pharmacology-III (P)	**0**	**0**	**2**	**30**	**1**	**VI**	**BP609P**

SCOPE: The Course aims to unravel the scientific principles governing drugs and their interactions with the human body. Knowledge of pharmacology can contribute to the development of new medications by studying the effects of drugs on cells, tissues, and organisms. The course helps identify potential therapeutic targets, design, and synthesize innovative compounds, and assess their safety and effectiveness. It elaborates on drug-receptor interactions, signal transduction pathways, and the influence of drugs on physiological processes, contributing to a comprehensive understanding of their mechanisms of action.

This course sheds light on the body's processing of drugs, touching upon crucial aspects such as bioavailability, drug clearance, and drug-drug interactions. It promotes the safe usage of medications by identifying potential side effects and determining optimal dosage regimens to mitigate adverse reactions. Further, it imparts an in-depth understanding of variability in drug responses among individuals, pharmacogenetics, and drug interactions, guiding the selection of drug and dosage. Moreover, it facilitates academic career progression by enabling research to broaden pharmacology knowledge and training future scientists and healthcare professionals.

COURSE LEARNING OUTCOMES

Upon successful completion of the course student shall be able to;

KNOWLEDGE:

K1 : Discuss pharmacological features of the drugs.

K2 : Predict the mechanism of drugs that contribute to adverse drug reactions and contraindications.

K3 : Illustrate the principles and application of immuno-pharmacology and pharmacogenomics.

K4 : Explain the fundamental principles in the management of poisoning.

K5 : Describe the concept of chrono-pharmacology and its implications for drug therapy.

K6 : Assess various tissue parameters from the given samples.

SKILL:

S1 : Justify the relevance of drugs in the pharmacological management of various disorders.
S2 : Predict the drug interactions in each prescription.
S3 : Identify the signs and symptoms of drug poisoning.
S4 : Recommend a chrono-pharmacological approach to optimize drug therapy.
S5 : Perform skillfully various tissue analysis.
S6 : Operate different lab equipment according to SOPs for preclinical experimentation.

ATTITUDE:

A1 : Appreciate the knowledge of Pharmacology for learning pharmacotherapy and toxicology.
A2 : Demonstrate a commitment to lifelong learning and professional development.
A3 : Communicate with everyone effectively.
A4 : Participate in healthcare initiatives.
A5 : Support other healthcare professionals in educating society.
A6 : Exhibit professionalism in the working environment.

COURSE CONTENTS

UNIT I **7 Hours**

Pharmacology of drugs acting on the Respiratory system
Anti-asthmatic drugs, and drugs used in the management of COPD (2 hrs)
Expectorants, antitussives (Cough) (1 hr)
Pharmacology of drugs acting on the Gastrointestinal Tract
Antiulcer agents. (2 hrs)
Diarrhoeals and Anti diarrhoeals (1hr)
metics and anti-emetics. (1 hr)

UNIT II **6 Hours**

Chemotherapy
Introduction: General principles of chemotherapy. (1 hr)
Sulfonamides and cotrimoxazole. (1 hr)
Antibiotics- Penicillins, Cephalosporins (2 hrs)
Chloramphenicol, macrolides, tetracycline and aminoglycosides (1 hr)
Fluoroquinolins, Urinary antiseptics (1 hr)

UNIT III **6 Hours**

Chemotherapy
Antitubercular agents (2hrs)
Antifungal agents (1hr)

Antiviral drugs (1hr)
Anthelmintics (1hr)
Antimalarial drugs (1hr)

UNIT IV **7 Hours**

Chemotherapy
Classification of different anticancer drugs (1hr)
Pharmacology of different anticancer drugs (3 hrs)
Immunopharmacology
Immunostimulants, immunosuppressant (2hrs)
Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars (1 hr)

UNIT V **4 Hours**

Principles of toxicology

General principles of treatment of poisoning (1 hr)
Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. (1 hr)
Chronopharmacology: Definition of rhythm and cycles; Biological clock and their significance leading to chronotherapy. (1 hr)
Pharmacogenomics: Definition, Significance of pharmacogenomics in drug therapy (1hr)

LIST OF EXPERIMENTS

1. Demonstrate of the handling of various laboratory animals
2. Perform isolation and collection of the organs from laboratory animals
3. Prepare various buffer solutions for tissue homogenization.
4. Preparation of solutions required to preserve various animal tissues.
5. Estimation of catalase activity in tissue sample
6. Estimation of GSH activity in tissue sample
7. Estimation of Histamine levels in tissue sample
8. Perform tissue processing for histopathology.
9. Perform microtome sectioning of tissues.
10. Perform H & E staining and evaluation of tissue for histopathological analysis.
11. Isolation and quantification of RNA from tissue.
12. Isolation and quantification of DNA from tissue.

TEXT BOOKS:

1. Kharen W. Lippincott Illustrated Reviews: Pharmacology. 8th edn. Wolters Kluwer (Inidia) Pvt. Ltd.2022.
2. Tripathi KD. Essentials of medical pharmacology. 8th edn. Jaypee: Delhi, 2018.

3. Ghosh MN. Fundamentals of Experimental Pharmacology. 7th edn. India: Hilton & Company; 2019. (Practical)

REFERENCE BOOKS:

1. Laurence LB, Randa HD, Björn CK. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 13thedn, McGraw Hill: New York, 2017..

2. James R, Rod F, Graeme H, Yoon KL, David, Humphrey R. Rang & Dale's Pharmacology. 9thedn. Churchill Living stone: Edinburgh Elsevier, 2020.

3. Katzung BG, Kruidering HM, Trevor AJ. Basic & Clinical Pharmacology.15thedn, McGraw-Hill Education: New York, 2019.

4. Satoskar RS, Bhandarkar SD, Nirmala N. Pharmacology and Pharmacotherapeutics. 26th edn. Popular Prakashan; 2020

ONLINE SOURCES:

1. https://cpcsea.nic.in/Content/55_1_GUIDELINES.aspx .2022. CPCSEA guidelines for laboratory animal facility

2. Indian Journal of Pharmacology; https://www.ijp-online.com/

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Biopharmaceutics and Pharmacokinetics (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP603T**

SCOPE: The course focuses on the study of the relationship between the physicochemical properties of a drug, its formulation and route of drug administration on the behaviourof drug in the body. It emphasizes the principles underlying drug absorption, distribution, metabolism, excretion as well as factors influencing these processes. It explores the mechanism of drug absorption across biological membranes and factors influencing drug dissolution. It discusses the factors affecting drug distribution, its barriers and protein binding of drugs. The course includes pathways of drug metabolism and excretion routes. The course gives the concept of bioavailability and bioequivalence.

The course introduces Pharmacokinetics that deal with the quantitative study of drug movement within the body, including processes like absorption, distribution, metabolism, and elimination. It also discusses various pharmacokinetic approaches to study the drug movement in the body. The course imparts knowledge and skills of biopharmaceutics and also appreciates the principles of pharmacokinetics in drug product development.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Outline the basic principles of biopharmaceutics, including drug absorption, distribution, metabolism, elimination processes and the factors affecting it

K2: Illustrate the factors affecting drug absorption and distribution.

K3: Examine the biotransformation of drugs in the body, including phase I and phase II reactions, drug metabolism enzymes, and factors affecting drug excretion.

K4: Explain the concepts of bioavailability and bioequivalence and its methods of estimation.

K5: Classify the different approaches in pharmacokinetic modelling of drugs

K6: Describe the pharmacokinetics of drugs following compartment models and drugs showing nonlinear kinetics.

SKILL

S1: Identify the absorption process of different classes of drug based on mechanism.
S2: Assess the clinical significance of plasma protein binding of drugs
S3: Determine the order of reaction of the drug movement in the body using the given data

S4: Estimate fraction of the administered dose (relative and absolute bioavailability) that enters systemic circulation

S5: Illustrate Compartment models (one and two) to give visual representation of drug disposition and rate process associated with it.

S6: Calculate pharmacokinetic parameters including clearance, volume of distribution, and half-life using the plasma concentration tome profile

ATTITUDE

A1: Cooperate and work effectively in groups to study ADME of drugs.
A2: Communicate effectively through presentations.
A3: Follow emerging trends in the field of pharmaceutical sciences
A4: Appreciate all the efforts to improve the knowledge
A5: Cultivate empathy and compassion.
A6: Embrace lifelong learning during professional development

COURSE CONTENTS

UNIT I **8 Hours**

Absorption:

Route of drug absorption and passive diffusion of drugs, Absorption of drug from Non per oral extra-vascular routes Mechanisms of drug absorption through GIT (2hrs)

Physicochemical, pharmaceutical and patient related factors influencing drug absorption though GIT, pH partition Hypothesis. (2hrs)

Distribution:

Definition, Tissue permeability of drugs, Apparent volume of drug distribution (1 hr)

Plasma and tissue protein binding of drugs(1 hr)

Factors affecting protein-drug binding.(1 hr)

Kinetics and Clinical significance of protein binding of drugs.(1 hr)

UNIT II **6 Hours**

Elimination:

Biotransformation: Definition and significance, Drug metabolising Enzymes (Drug metabolism and basic understanding of metabolic pathways. (1 hr)

Factors affecting renal excretion of drugs, Renal clearance, (Renal and non renal routes of excretion of drugs) (1 hr)

Bioavailability and Bioequivalence:

Definition and Objectives **,**Absolute and relative bioavailability(1 hr)

Measurement of bioavailability**,** Bioequivalence studies(2 hrs)

Methods to enhance the dissolution rates and bioavailability of poorly soluble drugs (1 hr)

UNIT III **10 Hours**

Pharmacokinetics:

Definition and introduction to Pharmacokinetics. Overview of plasma drug concentration time profile.Mathematical Fundamentals in pharmacokinetics (1 hr)

Rate, rate constants and order of reactions.(1 hr)

Pharmacokinetic models: Compartment models, Non compartment models, physiological models.(1 hr)

Pharmacokinetic and pharmacodynamic parameters. Definitions and estimation of pharmacokinetics parameters - K_e, $t_{1/2}$, Vd, AUC, K_a, Clt and CL_R.(2 hrs)

One compartment open model

Pharmacokinetics of Intravenous Injection (Bolus) in blood and urine (2 hrs)

Pharmacokinetics of Intravenous infusion: Introduction to steady state drug levels, loading and maintenance doses and their significance in clinical settings.(1 hr)

Pharmacokinetics of Extravascular administration: Determination of Absorption rate Constant by Wagner Nelson and method of residuals.(2 hrs)

UNIT IV **3 Hours**

Multi compartment models*:*

Introduction - Two compartment open model. (1 hr)

Pharmacokinetics of IV bolus(2 hrs)

UNIT V **3 Hours**

Nonlinear Pharmacokinetics:

Introduction , Factors causing Non-linearity.(1 hr)

Michaelis-menton method of estimating parameters and explanation with example of drugs.(2 hrs)

TEXT BOOKS:

1. Brahmankar DM, JaiswalSB.Bio pharmaceutics and Pharmacokinetics-A Treatise, 3rd edn, VallabhPrakashan,Pitampura, Delhi, 2019.

2. V Venkateswaralu. Biopharmaceutics and Pharmacokinetics, PharmaMed Press, 2nd edn 2017
3. Shargel L and Yu AB. Applied Biopharmaceutics and Pharmacokinetics, 7th edn McGraw Hill; 2016

REFERENCE BOOKS:

1. Milo Gibaldi. Biopharmaceutics and Clinical Pharmacokinetics, 4thedn PharmaMed Press, Hyderabad, 2011.

2. Robert E Notari. Biopharmaceutics and Clinical Pharmacokinetics: An introduction 4th edn Marcel Dekker Inc.,U.S. 2019.

ADDITIONAL MATERIALS:

1. European Journal of Pharmaceutics and Biopharmaceutics https://www.sciencedirect.com/journal/european-journal-of-pharmaceutics-and-biopharmaceutics

2. http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Industrial Pharmacy II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP604T**

SCOPE: This course is designed to impart fundamental knowledge on pharmaceutical product scale-up and translation from laboratory to market. It gives an insight into developing defect-free pharmaceutical products that eventually save time, human resources and capital.

The course describes the development of innovative and generic pharmaceuticals. It helps to understand the networks & responsibilities of various national and international regulatory authorities. It also gives a basic knowledge of biostatistics, data management and presentation. It discusses different regulatory bodies of India for technology transfer and related legal documents. It provides a fundamental understanding of International Organization for Standardization. In the classroom, students are encouraged to lead a group, take responsibility, follow institutional ethics and regulations, and engage in group tasks, which helps to potentiate students' leadership quality, sincerity and humanity.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, students shall be able to;

KNOWLEDGE

K1: Explain the pilot plant and scale-up of pharmaceutical dosage forms.
K2: Classify different levels of Scale Up and Post-Approval Changes (SUPAC).
K3: Describe the process of technology transfer from lab scale to commercial batch.
K4: Discuss different principles to minimize defects in pharmaceutical products.
K5: List technology transfer agencies in India.
K6: Compare the regulatory requirements in different stages of drug development.

SKILL

S1: Develop clinical research protocol.
S2: Diagnose the risk involved in pharmaceutical technology transfer/commercialization
S3: Demonstrate a problem from the case study of technology transfer and development.
S4: Comment on Six Sigma Concept.
S5: Implement biostatistics in pharmaceutical product development.
S6: Demonstrate the responsibility of regulatory affair professionals.

ATTITUDE

A1: Recognize and value others' efforts.
A2: Be responsible and sincere.
A3: Follow the regulations of the institute for good professionalism.
A4: Engage in class discussion in a meaningful way.
A5: Take responsibility and lead a group.
A6: Share and care for a harmonious workplace environment.

COURSE CONTENTS

UNIT I **7 Hours**

Pilot plant scale-up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, (1hr)
Pilot plant scale up considerations for solids(2hrs)
Liquid orals(1hr)
Semi-solids and relevant documentation, (1hr)
SUPAC guidelines, (1hr)
Introduction to platform technology(1hr)

UNIT II **6 Hours**

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol(1hr)
Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), (1hr)
Granularity of TT Process (API, excipients, finished products, packaging materials) (1hr) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, (1hr)
Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; (1hr)
TT related documentation - confidentiality agreement, licensing, MoUs, legal issues (1hr)

UNIT III **8 Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, (1hr)
Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals(1hr)
Regulatory requirements for drug approval: Non-Clinical Drug Development, (1hr)
Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, (1hr)

Investigator's Brochure (IB) and New Drug Application (NDA), (1hr)
Clinical research / BE studies, Clinical Research Protocols, (1hr)
Biostatistics in Pharmaceutical Product Development, (1hr)
Data Presentation for FDA Submissions, Management of Clinical Studies. (1hr)

UNIT IV **4 Hours**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, (1hr)
Quality by Design (QbD), (1hr)
Six Sigma concept, Outof Specifications (OOS), (1hr)
Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP (1hr)

UNIT V **5 Hours**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) (1hr)
State Licensing Authority: Organization, Responsibilities, (1hr)
Certificate of Pharmaceutical Product (COPP), (1hr)
Regulatory requirements and approval procedures for New Drugs. (2hrs)

TEXT BOOKS:

1. Pisano JD and Mantus DS. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' 2nd edn, CRC press 2008.
2. Khar RK, Vyas SP, Ahmad FJ, Jain GK. Theory and Practice of Industrial Pharmacy by Liberman & Lachman, 4th edn, CBS Publishers 2021.

REFERENCE BOOKS:

1. Remington: The Science and Practice of Pharmacy. 23rd edn, Elsevier, 2020.
2. Lachman L, Liberman HA, Kanig JL, The Theory and Practice of Industrial Pharmacy, Philadelphia (latest edition)

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Quality Assurance (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP605T**

SCOPE: This course provides a comprehensive understanding of the principles and guidelines related to quality assurance in the pharmaceutical sector. This includes knowledge of regulatory requirements, quality systems, documentation, and compliance with Good Manufacturing Practices (GMP). Students learn about various quality control techniques used in pharmaceutical manufacturing, such as sampling methods, analytical testing, and validation of analytical procedures.

This knowledge is essential for ensuring the quality and consistency of pharmaceutical products. It provides individuals with the knowledge and skills required to pursue a rewarding career in the pharmaceutical industry. The specific emphasis on attitudes may vary, but the overall goal is to develop a professional mindset that values quality, safety, compliance, and continuous improvement in the pharmaceutical industry.

COURSE LEARNING OUTCOMES

Upon successful completion of the course student shall be able to;

KNOWLEDGE

K1: Identify regulatory requirements and standards in the pharmaceutical industry.
K2: Review the cGMP aspects in the pharmaceutical industry
K3: Organise quality-related documents like Standard Operating Procedures (SOPs).
K4: Examine the importance of documentation
K5: Categorise the scope of quality certifications applicable to pharmaceutical Industries
K6: Compare the responsibilities of QA & QC departments

SKILL

S1: Identify the regulatory requirements and guidelines governing pharmaceutical quality assurance.
S2: Discover the concept of qualification, calibration, and validation of analytical instruments
S3: Demonstrate the application of quality risk management strategies in quality control of pharmaceuticals.
S4: Allocate analytical methods and instruments for quality assessment of pharmaceutical products.
S5: Ensure the importance of the auditing process and reporting
S6: Analyse and evaluate the effectiveness of quality systems within a pharmaceutical organisation.

ATTITUDE

A1: Develop a positive attitude towards maintaining high-quality standards in pharmaceutical manufacturing.

A2: Encourage critical thinking and problem-solving skills to anticipate potential quality issues.

A3: Ascertain the significance of documentation and record-keeping to ensure traceability and accountability.

A4: Demonstrate a commitment to upholding ethical principles and integrity in pharmaceutical quality assurance practices.

A5: Communicate with other team members to solve problems

A6: Foster a commitment to upholding regulatory standards.

COURSE CONTENTS

UNIT I **10 Hours**

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance, and GMP. **Total Quality Management (TQM):** Definition, elements, philosophies. (2 hrs)

ICH Guidelines: purpose, participants, the process of harmonisation, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines, General principles of Analytical method development and validation according to ICH Q2 guidelines.(6 hrs)

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities. (2 hrs)

UNIT II **10 Hours**

Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials. (2 hrs)

Quality Control: Quality control test for containers, rubber closures and secondary packing materials. (3 hrs)

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer. (5 hrs)

UNIT III **10 Hours**

Document maintenance in the pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and ,documents, distribution records. (6 hrs)

Warehousing: Good warehousing practice, materials management (2 hrs)

Complaints: Complaints, evaluation of complaints, Handling of returned goods, recalling, and waste disposal. (2 hrs)

TEXT BOOKS:

1. Weinberg, S. Good Laboratory Practice Regulations, 3rd edn, Revised and Expanded. CRC Press; United Kingdom: 2002.
2. Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials. Good manufacturing practices and inspection. World Health Organization; Taiwan: 2007.

REFERENCE BOOKS/ ONLINE READING :

1. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosageforms
2. Marcel Dekker. Good Laboratory Practices. Marcel Dekker Inc; 1995
3. ICH guidelines. (https://www.ich.org/page/quality-guidelines)
4. https://www.fda.gov/
5. https://www.iso.org/home.html
6. https://www.ema.europa.eu/en

JOURNALS:

Biomedical Chromatography.
https://analyticalsciencejournals.onlinelibrary.wiley.com/journal/10990801

Journal of Pharmaceutical and Biomedical Analysis.
https://www.sciencedirect.com/journal/journal-of-pharmaceutical-and-biomedical-analysis

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacotherapeutics (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP606T**

SCOPE: The course aims to comprehend the science behind the treatment of diseases/ disorders in humans. The subject offers insights into the basis behind the selection of drugs in various therapies and the role of pharmacological and non-pharmacological interventions in various diseases/disorders.

It delivers the safety of medications, identifies potential side effects, and determines appropriate dosage regimens to minimize adverse reactions. Besides, it imparts a better understanding of the importance of drug resistance and combating resistance in treating infections. Additionally, it helps in pursuing careers as a pharmacist and teaching future scientists and healthcare professionals.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, students shall be able to;

KNOWLEDGE

K1: Outline the different classes of clinically relevant drugs used for the management of various diseases/disorders

K2: Discuss the role of pharmacological and non-pharmacological interventions in various diseases/disorders

K3: Explain the basis behind the selection of drugs in various therapies

K4: Illustrate standard treatment guidelines used for various diseases/disorders

K5: Discuss the importance of drug resistance and combating resistance in treating infections.

K6: Describe the management of various diseases/ disorders

SKILL

S1: Justify the relevance of drugs in the pharmacological management of various disorders

S2: Predict the drug interactions in polypharmacy

S3: Recommend the possible alternatives to the drug therapy

S4: Identify the signs and symptoms of drug induced toxicity

S5: Convince the public about the rational use of medicines

S6: Recognize prescription errors.

ATTITUDE

A1: Appreciate the knowledge of therapeutics for learning other fields of medical sciences.

A2: Communicate with everyone effectively.

A3: Support and collaborate with others.

A4: Exhibit professionalism in the work environment.
A5: Participate in healthcare initiatives.
A6: Embrace the new advancements in the healthcare system.

COURSE CONTENTS

UNIT I **5 Hours**

Introduction to rational use of medicines, Evidence-based medicine, Essential Medicine List, Standard Treatment Guidelines (STGs) (2hrs)
Antimicrobial resistance, Mechanisms, Strategies to combat AMR, Role of Pharmacists in overcoming AMR (1hr)
Pharmacological and non-pharmacological management of,
SARS, CoV2, Conjunctivitis, AIDS (2hrs)

UNIT II **4 Hours**
Pharmacological and non-pharmacological management of,
Tuberculosis (1hr), Pneumonia(1hr), Malaria (1hr), UTI (1hr)

UNIT III **5 Hours**
Cardiovascular system
Pharmacological and non-pharmacological management of,
Hypertension (2hrs)
Myocardial Infarction (1hr)
Hyperlipidaemia (1hr)
Congestive Heart Failure (1hr)

UNIT IV **4 Hours**
GI system
Pharmacological and non-pharmacological management of,
GERD, NAFLD (1hr)
Cirrhosis(1hr)
eptic Ulcer, and IBD (2hrs)

UNIT V **6 Hours**
Pharmacological and non-pharmacological management of,
Asthma and COPD (2hrs)
Stroke and Migraine(2hrs)
Diabetes Mellitus (1hr)
Thyroid disorders (1hr)

UNIT VI **6 Hours**

Pharmacological and non-pharmacological management of,
Anaemia (1hr)
Rheumatoid Arthritis, and Osteoarthritis (1hr)
PCOS, Dysmenorrhea (1hr)
Cancer with emphasis on breast, colorectal, lung ,prostate and oral cancers (3hrs)

TEXT BOOKS:

1. Joseph T. Dipiro et al. Pharmacotherapy: A Pathophysiologic approach. 10th edn. Mc Graw-Hill; 2017
2. Rajvir Bhalwar,Puja Dudeja, Ashok Jindal. Text book of Community medicine.4th edn.Wolter"s Kluwer;2021.
3. Banerjee B. D K Tanejas Health policies and programmes in India.17th edn.Jaypee brothers medical publishers; 2023.

REFERENCE BOOKS:

1. Laurence LB, Randa HD, Björn CK. Goodman and Gilman's The Pharmacological Basis of therapeutics. 13thedn.McGraw Hill: New York; 2017

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Life Skills II (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VI**	**BP607T**

SCOPE: Life Skills training envisages to equip students with essential skills to conduct and perform better in their personal and professional life. Life Skills II is the second level course for the UG students, and it consists of three components namely Soft Skills, Aptitude Skills, and Verbal Skills. The topics covered include time management, goal setting, group discussion, equations, logarithms, sequence & series, time & work, time & distance, logical reasoning, vocabulary, grammar, reading comprehension and reasoning.

COURSE LERNING OUTCOMES

CO1: Soft Skills - To improve the inter-personal skills, professional etiquette and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.
CO2: Soft Skills - To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.
CO3: Aptitude - To interpret, critically analyse and solve questions in arithmetic and algebra by employing the most suitable methods.
CO4: Aptitude - To analyse, understand and apply suitable methods to solve questions on logical reasoning.
CO5: Verbal - To be able to use vocabulary in the right context and to be competent in spotting grammatical errors and correcting them.
CO6: Verbal - To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.
Skills: Communication, etiquette and grooming, inter-personal skills, listening skills, convincing skills, problem-solving skill.

COURSE CONTENTS:

SOFT SKILLS **15**

Time Management 2

Value of time, setting goals/planning and prioritization, procrastination, monitoring, tools for time management. Preparing personal time management schedules.

Goal Setting 2

Concept of goal setting, personal values and personal goals, six areas of goal setting, the process of goal setting: SMART goals, how to set SMART goals (Practice).

Personal Grooming and Practices 3

Basics of corporate culture, key pillars of business etiquette: socially acceptable ways of behaviour, body language, personal hygiene, professional attire, cultural adaptability, handling pressure, multi-tasking, and being enterprising.

Adapting to corporate life: adversity management, health consciousness, people skills, critical thinking and problem solving.

Group Discussion 1

The purposes of group discussions, types of group discussion and roles played in a group discussion, personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion.

Group Discussion Practice 7

APTITUDE SKILLS **15**

Equations 1

Basics, linear, quadratic, equations of higher degree, and problems on ages.

Logarithms, Inequalities and Modulus 1

Basics.

Sequence and Series 2

Basics, AP, GP, HP, and special series.

Time and Work 3

Basics, pipes & cistern, and work equivalence.

Time, Speed and Distance 3

Basics, average speed, relative speed, boats & streams, races, and circular tracks.

Logical Reasoning 5

Arrangements, sequencing, scheduling, Venn diagram, network diagrams, binary logic, and logical connectives, clocks, calendars, cubes, non-verbal reasoning and symbol based reasoning.

VERBAL SKILLS 15

Vocabulary 2

Help students understand the usage of words in different contexts.

Grammar (Medium Level) 6

Train students to comprehend the nuances of grammar and empower them to spot errors in sentences and correct them.

Reading Comprehension (Basics) 2

Introduce students to smart reading techniques and help them understand different tones in comprehension passages.

Reasoning 2

Enable students to connect words, phrases and sentences logically.

Oral Communication Skills 3

Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

REFERENCE BOOKS:

1. Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
2. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
3. The Hard Truth about Soft Skills, by Amazon Publication.
4. Verbal Skills Activity Book, CIR.
5. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
16. A Modern Approach to Logical Reasoning, R S Aggarwal.
17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal

SEMESTER-VII

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Instrumental Methods of Analysis (T)	**3**	**0.5**	**0**	**45**	**3.5**	**VII**	**BP701T**
Instrumental Methods of Analysis (P)	**0**	**0**	**2**	**30**	**1**	**VII**	**BP714P**

SCOPE: This course focuses on the principles, techniques, and applications of various analytical instruments used in the pharmaceutical sector. This course deals with gaining a working knowledge of many instrumental analytical methods used in a modern pharmaceutical lab for qualitative and quantitative analysis of drugs. It is designed to impart fundamental knowledge on the principle, instrumentation, and application of spectroscopic and chromatographic techniques. This will expose students to the theoretical explanation of the observed phenomena and the practical aspect of the various instruments. This course will provide opportunities for students to develop strategies for troubleshooting instrument-related issues and resolving analytical challenges.

The course also introduces students to emerging analytical techniques, such as hyphenated techniques and their applications. Hands-on laboratory sessions and practical training on instrument operation and data analysis are integral to this course.
This course emphasises the importance of professionalism in analytical science, including integrity, responsibility, and accountability. This will foster a mindset of critical thinking and problem-solving in analytical scenarios.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1. Recognise common terminologies and definitions used in the instrumental analysis (Understanding)
K2. Discuss the interaction of matter with electromagnetic radiation and its applications in drug analysis (Applying)
K3. Illustrate the fundamental principles and applications of various spectroscopic and Chromatographic techniques (Applying)
K4. Explore basic practical skills using instrumental techniques including the importance of sample preparations and solvent selection (Applying)
K5. Ensure appropriate instrumental techniques for the qualitative and quantitative analysis of drugs (Evaluate)
K6. Compose new analytical methods or optimise existing methods using instrumental techniques. (Create)

SKILL
S1. Compare Operational techniques of UV, HPLC fluorimeter, flame photometer etc. (Understanding)

S2. Develop basic practical skills using instrumental techniques (Applying)
S3. Correlate quantitative & qualitative analysis of drugs using various analytical instruments (Analysing)
S4. Select appropriate instrumental techniques for the qualitative and quantitative analysis of drugs (Analysing)
S5. Interpret the data generated by analytical instruments and understand the significance of the results. (Analysing)
S6. Evaluate knowledge of interpretation of data obtained from spectra and of chromatograms (Evaluate)

ATTITUDE

A1. Show enthusiasm and curiosity towards exploring new techniques and their applications. (Applying)
A2. Explore opportunities for continuous learning and staying updated with advancements. (Applying)
A3. Attain confidence in handling and operating instruments effectively and safely. (Applying)
A4. Embrace professionalism by adhering to ethical standards and best practices in research and data handling. (Applying)
A5. Demonstrate confidence in troubleshooting instrument-related issues and identifying appropriate solutions. (Analysing)
A6. Manage effective communication skills in conveying analytical findings and collaborating with peers and professionals in the field. (Analysing)

COURSE CONTENTS:

UNIT –I **10 hours**

Introduction to Spectroscopy

UV Visible spectroscopy
Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Single beam and Double Beam UV-Visible Spectrophotometers. Applications - Single component analysis, Derivative Spectroscopy and Difference Spectroscopy, Derivatisation Spectroscopy. (5 hrs)

Fluorimetry
Theory, Jablonski Diagram, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications(2 hrs)
Flame Photometry-Principle, interferences, instrumentation and applications (1 hr)
Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications(1 hr)
Nepheloturbidometry- (Principle, instrumentation and applications)(1 hr)

UNIT –II **12 hours**

IR spectroscopy
Introduction, fundamental and non-fundamental modes of vibrations in polyatomic molecules, sample handling, factors affecting vibrations, Near IR, Mid IR, ATR. Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector. FT-IR and applications (6 hrs)

Introduction and application of Mass Spectrometry and Nuclear Magnetic Resonance spectroscopy (H & C13) **(**6 hrs)

UNIT –III **14 hours**

Introduction to chromatography (3 hrs)
Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.
Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.
Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

HPTLC: Introduction, theory, instrumentation, and applications Hyphenated techniques-HPTLC-MS/MS. **(**3 hrs)

High performance Liquid Chromatography (HPLC)-Introduction, theory, Selection of Mobile Phase, instrumentation, applications. Single component and Multicomponent analysis. Hyphenated techniques-LC-MS/MS. (6 hrs)

Gas chromatography - Introduction, theory, instrumentation, derivatisation, temperature programming and applications Hyphenated techniques-GC-MS/MS. (3 hrs)

UNIT –IV **6 hours**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications (3 hrs)
Gel chromatography- Introduction, theory, instrumentation and applications (2 hrs)
Affinity chromatography- Introduction, theory, instrumentation and applications. (1 hr)

UNIT –V **2 Hours**

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, SDS-PAGE, capillary electrophoresis, applications (2 hrs).

LIST OF EXPERIMENTS

1. Determination of Isobestic Point of Bromocresol Green Solution
2. Determination of dissociation constant using UV-Visible spectroscopy.

3. Estimation of drugs by Fluorimetric technique.
4. Study of quenching effect in fluorimetry
5. Assay of Furosemide injection by absorptivity value method
6. Assay of Paracetamol tablets by absorptivity value method
7. Assay of Paracetamol tablets by UV- Spectrophotometry using calibration graph method, direct comparison method, absorbtivity value method and linear equation method
8. Assay of Chloramphenicol capsules by UV- Spectrophotometry using calibration graph method, direct comparison method and linear equation method
9. Assay of Rifampicin by colorimetry using absorbtivity value method
10. Assay of Paracetamol by colorimetry using calibration graph method, direct comparison method , absorbtivity value method and linear equation method
11. Assay of Salicylic Acid By Colorimetry
12. Determination of sodium by flame photometry
13. Determination of potassium by flame photometry
14. Assay of Paracetamol by RP-HPLC
15. Interpretation of organic compounds by IR

TEXT BOOKS

1. Becket A.H. & Stenlake J.B. Practical Pharmaceutical Chemistry Vol. I and II, 4th edn, the Athlone Press of the University of London. 1998. (Theory and Practical)
2. Silverstein, R. M., Webster, F. X., Kiemle, D. J. Spectrometric Identification of Organic Compounds. 6th edn.Wiley India Pvt. Limited. 2006.
3. Willard, H.H., Merritt, L.L., Dean, J.A., & Settle, F.A. Instrumental methods of analysis, 7th edn. EWP, East West Press Ltd., Delhi/Madras. 1988.
4. Stahl, E. Thin-Layer Chromatography: A Laboratory Handbook. Germany: Springer Berlin Heidelberg. Higuchi. T and Hasen. E. B. Text Book of Pharm. Analysis. New York Inter Science Publishers. 2013. (Practical)

REFERENCE BOOKS

1. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WBSaunders. 1997
2. Sethi, P. D. Sethi's HPLC High Performance Liquid Chromatography: Quantitative Analysis of Pharmaceutical Formulations, Volume 8. India: CBS Publishers & Distributors. 2015. (Practical)

JOURNALS:

Biomedical Chromatography.
https://analyticalsciencejournals.onlinelibrary.wiley.com/journal/10990801

Journal of Pharmaceutical and Biomedical Analysis.
https://www.sciencedirect.com/journal/journal-of-pharmaceutical-and-biomedical-analysis

Separations https://www.mdpi.com/journal/separations

** latest edition of text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Novel Drug Delivery Systems (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP702T**

SCOPE: This course is intended to provide fundamental knowledge in the field of novel drug delivery systems to overcome the limitations of conventional drug delivery systems. This also helps to understand the critical criterion for selecting drugs and polymers in developing specific novel and controlled drug delivery system. In the course, topics like microencapsulation, elaborately explain coating of solid particles and liquid droplets. The mechanism of musoadhesion helps to understand the interactive nature of polymers with mucous membranes.

It includes implantable, transdermal drug delivery systems and intrauterine devices designed for months-long drug delivery. Drugs can be directly delivered to the lungs through inhalators. It also discusses intra-ocular barriers and methods to overcome them, which helps to design the formulations to facilitate posterior eye drug delivery. Students participate in group discussions, individual performances, and time-bound tasks in the classroom, which helps improve students' friendly behavior, personality growth, and competency.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, students shall be able to

KNOWLEDGE:

K1: Discuss the basic terminology of novel drug delivery systems.
K2: Explain the criteria for the selection of drugs and polymers for the development of Novel drug delivery systems
K3: Describe various approaches for the development of novel drug delivery systems.
K4: Classify gastroretentive drug delivery system.
K5: Elaborate methods of microencapsulation.
K6: Comment on biological barriers for drug delivery.

SKILL

S1: Design a suitable targeted drug delivery system for specific targeting.
S2: Articulate the fate of the drug through an NDDS to the biological system
S3:Resolve the problem of the existing conventional dosage forms.
S4: Comment on mucoadhesive mechanism.
S5: Differentiate between nasal and pulmonary drug delivery systems.
S6: Assess the challenges of implantable drug delivery system.

ATTITUDE

A1: Motivate your fellow beings to be good team players.
A2: Maintain your focus in class.
A3: Follow the value of lifelong learning.
A4: Participate actively in class discussions.
A5: Be polite and humble
A6: Show kindness for our fellow beings.

COURSE CONTENTS

UNIT I **7 Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages,(1hr)
selection of drug candidates. Approaches to design controlled release formulations based on diffusion, (1hr)
dissolution and ion exchange principles. (1hr)
Physicochemical and biological properties of drugs relevant to controlled release formulations(1hr)
Polymers: Introduction, classification, (1hr)
properties, advantages and application of polymers in formulation of controlled release drug delivery systems. (2hrs)

UNIT II **7 Hours**

Microencapsulation: Definition, advantages and disadvantages, (1hr)
microspheres microcapsules, micro particles, methods of microencapsulation(3hrs)
applications
Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, (1hr)
trans mucosal permeability and Formulation considerations of buccal delivery systems(1hr)
Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump (1hr)

UNIT III **5 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, (1hr)
basic components of TDDS, formulation approaches (1hr)
Gastro retentive drug delivery systems: Introduction, advantages, disadvantages,approaches for GRDDS – Floating, high density systems, inflatable and gastro adhesive, systems and their applications (1hr)
Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers: dry powder and metered dose, nasal sprays, nebulizers (2hrs)

UNIT IV **5 Hours**

Targeted drug Delivery: Concepts and approaches (3hrs)
Advantages and disadvantage,introduction to liposomes, noisome, nanoparticles, (1hr)
monoclonal antibodies and their applications (1hr)

UNIT V **6 Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers (2hrs)
and methods to overcome, (1hr)
ocular formulations: conventional, novel and ocuserts (1hr)
Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages (1hr)
development of intrauterine devices (IUDs) and applications (1hr)

TEXT BOOKS:

1. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York.(latest edition)
2. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi. (latest edition).
3. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, 1st edn Vallabh Prakashan, New Delhi, 2002

REFERENCE BOOKS:

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edn, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Mathiowitz E. Encyclopedia of Controlled Delivery. Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim, 1999.
3. Hong Wen, Kinam Park, Oral Controlled Release Formulation Design and Drug Delivery: Theory to Practice, Wiley, 2011.

JOURNALS:

1. Journal of Controlled Release
2. International Journal of Pharmaceutics
3. Drug Development and Industrial Pharmacy

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Biostatistics & Research Methodology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP703T**

SCOPE: The course provides an introduction to research methodologies in education, both qualitative and quantitative. It encompasses the application of statistical techniques and research methodologies to the study of health-related data and biomedical research. This course focuses on the selection and design of appropriate study designs for different types of research, such as observational studies (cohort studies, case-control studies), experimental studies (randomized controlled trials), and epidemiological studies. It also includes various methods of collection of relevant data for research purposes.

This course deals with descriptive statistics, inferential statistics, regression analysis, and the application of statistical methods to assess associations, test hypotheses, and draw meaningful inferences from the data as well as the utilization of statistical software packages routinely used in pharmaceutical and clinical research. This course highlights the significance of maintaining data integrity, respecting confidentiality, and engaging with various interdisciplinary researchers to undertake high-quality research.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to

KNOWLEDGE

K1 : State the fundamental statistical concepts and methods used in pharmaceutical and clinical research.

K2 : Outline various study designs and their appropriate applications in different research scenarios.

K3 : Discuss the different types of sampling design and identify the various steps in sampling design

K4 : Distinguish between different types of data in research and various methods used for data collection

K5 : Explain key components of research design and statistical analysis, including observational studies, clinical trials, and survey studies

K6 : Review the application of statistical software tools in data management and analysis

SKILL

S1 : Interpret statistical methods and techniques to health-related data
S2 : Design study protocols, including data collection tools and study methods.
S3 : Communicate research findings effectively through written reports, visualizations, and presentations
S4 : Derive appropriate statistical models with suitable assessment based on various samples relevant to pharmaceutical/clinical research
S5 : Interpret the data generated in biology, public health and other health sciences using modern statistical methods
S6 : Use various computer software to organize, input and analyze data, output results and interpret them (M.S. Excel, SPSS, JMP)

ATTITUDE

A1 : Express commitment to ethical conduct and adherence to research regulations and guidelines

A2 : Participate in activities for continuous learning and updating knowledge and skills

A3 : Respect data integrity, confidentiality, and protection of human subjects

A4 : Manage effective communication skills in conveying analytical findings

A5 Appreciate the value of interdisciplinary collaboration in conducting high-quality biomedical research

A6 : Assist the healthcare professionals in implementing the correct statistical methods

COURSE CONTENTS:

UNIT I **8 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution, Data (1 hr)

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples (2hrs)

Measures of dispersion: Dispersion, Range, Variance, standard deviation, Mean deviation, Pharmaceutical problems (2 hrs)

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples (2 hrs)

Data presentation: Tables and Graphs (Line graph, Bar diagram, Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph, semilogarthimic plot) (1 hr)

UNIT II **8 Hours**

Probability: Definition of probability, Poisson's distribution, properties - problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, Error I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples (3 hrs)

Parametric test: t-test (Sample, Pooled or Unpaired and Paired), ANOVA, (One way and Two way), Least Significance difference (3 hrs)

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman test (2hrs)

UNIT III **6 Hours**

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism (2hrs)

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases. (2hrs)

Sampling: Probability and Non-probability sampling (1 hr)

Statistical software: statistical analysis using excel and standard software (1 hr)

UNIT IV **4 Hours**

Blocking and confounding system for Two-level factorials (1 hr)

Regression modeling: Hypothesis testing in Simple and Multiple regression models (1 hr)

Introduction to Practical components of Industrial and Clinical Trials Problems: DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach (2hrs)

UNIT V **4 Hours**

Design and Analysis of experiments:

Factorial Design: Definition, 2^2, 2^3design. Advantage of factorial design (2hrs)

Response Surface methodology: Central composite design, Historical design, Optimization Techniques (2hrs)

TEXT BOOKS:

1. Sundaram K R, Dwivedi S N and Sreenivas V; Medical Statistics: Principles and Practice, 2nd Edition, Wolters Kluwer | Lippincott Williams and Wilkins India; 2014
2. BayyaSubba Rao; Pharmaceutical Research Methodology and Bio-Statistics: Theory and Practice, PharmaMed Press / BSP Books India: 2020
3. Saha I, Paul B. Essentials of biostatistics & research methodology. 3rded. Kolkata: Academic Publishers; 2021

REFERENCE BOOKS:

1. Gupta S. C., Fundamentals of Statistics: 7th edn, Himalaya Publishing House: 2017.
2. Douglas C. M, Design and Analysis of Experiments 10th edn, Wiley India: 2019.
3. Sanford B; Pharmaceutical statistics- Practical and clinical applications, 5th edn, Marcel Dekker Inc. New York: 2009

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharma Marketing Management (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP704ET**

SCOPE: The pharmaceutical industry not only needs highly qualified researchers, chemists and technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The course encompasses a broad scope of topics related to marketing in the pharmaceutical industry. The course focuses on understanding and implementing effective marketing strategies in the pharma sector.

Additionally, the course delves into pricing concepts, including its meaning, importance, objectives, determinants, methods, and strategies. It also addresses specific issues in price management within the pharmaceutical industry and provides an overview of the Drug Price Control Order (DPCO) and the National Pharmaceutical Pricing Authority (NPPA). These topics collectively provide students with a comprehensive understanding of marketing management in the pharmaceutical sector, enabling them to effectively navigate the challenges and opportunities in this industry. By studying these topics, students develop a strong foundation in pharmaceutical marketing management, enabling them to understand market dynamics, make informed decisions regarding product development and promotion, manage sales and distribution channels, and navigate pricing challenges within the pharmaceutical industry.

COURSE LEARNING OUTCOMES:

Upon successful completion of the subject student shall be able to;

KNOWLEDGE

K1. Explain the key concepts and terminologies related to pharmaceutical marketing management.
K2. Describe the principles and theories underlying marketing strategies in the pharmaceutical industry.
K3. Apply the acquired knowledge to develop effective marketing plans for pharmaceutical products.
K4. Analyze market trends and competition to identify opportunities and challenges in pharmaceutical marketing.
K5. Evaluate the effectiveness of different marketing strategies and tactics used in the pharmaceutical industry.
K6. Design innovative marketing campaigns and promotional activities to create a competitive edge in the market.

SKILL

S1. Conduct market research to gather relevant data and insights for pharmaceutical marketing decision-making.
S2. Apply strategic marketing plans and tactics for launching and promoting pharmaceutical products.
S3. Implement brand management strategies to enhance the brand value and positioning of pharmaceutical products.
S4. Plan sales and distribution channels to ensure effective product availability and reach.
S5. Use digital marketing tools and platforms to enhance the online presence and visibility of pharmaceutical products.
S6. Develop effective communication skills to engage with healthcare professionals, stakeholders, and consumers.

ATTITUDE

A1. Demonstrate ethical and responsible behaviour in pharmaceutical marketing, adhering to industry regulations and guidelines.
A2. Adopt a customer-centric mindset to understand and fulfill the needs and preferences of healthcare professionals and patients.
A3. Foster a commitment to continuous learning and stay updated with emerging trends and advancements in pharmaceutical science.
A4. Collaborate effectively with cross-functional teams to develop and execute learning strategies.
A5. Apply critical thinking skills to evaluate market dynamics for informed decisions in pharmaceutical marketing.
A6. Adapt to changes in the pharmaceutical market landscape for customer needs.

LECTURE WISE CONTENTS:

UNIT I **09 Hours**

Marketing:
Definition, General concepts and scope of marketing, Distinction between marketing & selling (1hr)
Marketing environment, Industry and competitive analysis (1hr)
Analyzing consumer buying behaviour, Industrial buying behaviour (2hrs).
Pharmaceutical marketing:
Quantitative and qualitative aspects, Size and composition of the market (1hr)
Market segmentation& targeting, Consumer profile (1hr)
Motivation and prescribing habits of the physician (1hr)
Patients' choice of physician and retail pharmacist (1hr)
Analyzing the Market; Role of market research (1hr).

UNIT II **06 Hours**

Product decision:
Classification, Product line and product mix decisions (1hr)
Product life cycle, product portfolio analysis, Product positioning (1hr)
New product decisions (1hr)
Product branding, packaging and labelling decisions (1hr)
Product management in pharmaceutical industry (1hr)
Process involved in the launch of a product into market (1hr).

UNIT III **05Hours**

Promotion:
Methods, Determinants of promotional mix, Promotional budget (1hr)
An overview of personal selling, Advertising (1hr)
Direct mail, Journals, Sampling (1hr)
Retailing, Medical exhibition (1hr)
Public relations, Online promotional techniques for OTC Products (1hr).

UNIT IV **06 Hours**

Pharmaceutical marketing channels:
Designing channel, Channel members (1hr)
Selecting the appropriate channel, Conflict in channels (1hr).
Professional sales representative (PSR):
Duties of PSR, purpose of detailing, Selection and training (1hr)

Supervising, Norms for customer calls (1hr)

Motivating, Evaluating (1hr)
Compensation and future prospects of the PSR (1hr).

UNIT V **04 Hours**

Pricing
Meaning, Importance, Objectives (1hr)
Determinants of price;Pricing methods and strategies (1hr)
Issues in price management in a pharmaceutical industry (1hr)
An overview of DPCO and NPPA (1hr).

TEXT BOOKS

1. Rao. S. Pharma Marketing Management: Principles and Practice. 1st edn, Pharma Med Press, Hyderabad. 2019.
2. Oparah, A.C. Weber. R.J. Marketing for Pharmacists Edition. 2nd edn, Jones & Bartlett Learning, USA. 2018.
3. Shah. B., A Textbook of Pharmaceutical Industrial Management. 1st edn, Elsevier Health Sciences, Sydney. 2012.

REFERENCE BOOKS

1. Mangal. S. Pharma Sales and Marketing: A Practical Guide. 2nd edn, Pharma Book Publishing, Mumbai. 2018.
2. Thomas. R. Pharmaceutical Marketing: Principles, Environment, and Practice. 4th edn, Pharma Press. New Delhi. 2017.
3. Grewal D., Levy M.. Marketing. 2nd edn, Tata MC Graw Hill, London. 2011.

JOURNALS:

1. Journal of Pharmaceutical Marketing & Management

   Website: https://www.tandfonline.com/toc/hpmm20/current

2. International Journal of Pharmaceutical and Healthcare Marketing

   Website: https://www.emeraldgrouppublishing.com/journal/ijphm

3. Journal of Medical Marketing

   Website: https://journals.sagepub.com/home/jmm

** latest edition of text books & reference books can be reffered.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmaceutical Regulatory Science (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP705ET**

SCOPE: This course is intended to provide fundamental knowledge on the regulatory requirements for the approval of new drugs and drug products in regulated markets in India and other. It prepares students to thoroughly understand the regulatory requirements, documentation requirements, and registration procedures for marketing pharmaceutical products. This course offer the students to understand the process of development, monitoring and legal requirements of clinical trial.

It gives an insight of different technical documents essential for pharmaceutical regulatory submission around the globe. Students also learn about Emergency approval of pharmaceuticls in special case. In the classroom students participate in group discussion, individual performance, and challenging tasks, which helps to potentiate students' collaborative behavior, personality growth and compassion.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, student shall be able to;

KNOWLEDGE

K1: Discuss the regulatory process of drug development

K2. Explain the regulatory approval process and their registration in Indian and international markets

K3: Construct Technical documentation

K4: Decribe the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals in India and Overseas.

K5. List the contents of Orange Book.

K6. Differentiate innovator and generic drug product development process.

SKILL

S1: Develop the clinical trial protocol.

S2: Measure the cost of drug development.

S3: Compare the regulatory protocols of India and other countries

S4: Comment on emergency use authorization.

S5: Identify the ethical issues of clinical trials.

S6: Elaborate the responsibilties of Institutional Review Board.

ATTITUDE

A1: Appreciate the work of others.

A2: Be sincere and punctual.

A3: Be a role model for others. .

A4: Participate actively in the discussions.

A5: Support your team members for better outcomes.

A6: Share and care for good harmony and work culture.

COURSE CONTENTS

UNIT I **3 Hours**

New Drug Discovery and development

Stages of drug discovery, Drug development process, (1hr)
Pre-clinical studies,Non-clinical activities,
Clinical studies, Innovator and generics, (1hr)
Concept of generics, Generic drug product development. (1hr)

UNIT II

Regulatory Concepts and Regulatory Approval Process **10 Hours**

Basic terminology: Guidance,Guidelines, Regulations, Laws and Acts (1hr)
Orange book (1hr)
Approval processes and timelines involved in Investigational New Drug (IND)(1hr)
New Drug Application (NDA) (1hr), Abbreviated New Drug Application (ANDA)(1hr)
Changes to an approved NDA / ANDA. (1hr)
Emergency Use Authorization, (1hr)
Public Readiness and Emergency Preparedness Act (PREP Act) (1hr)

Regulatory authorities and agencies

Overview of regulatory authorities of India, (1hr)
United States, European Union, Australia, Japan, Canada (Organization structure and types of applications(2hrs)

UNIT III **10 Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products (2hrs)
Technical documentation (1hr)
Drug Master Files (DMF) (3hrs)
Common Technical Document (CTD) (1hr)
Electronic Common Technical Document (eCTD) (1hr)
ASEAN Common Technical Document (ACTD) research(2hrs)

UNIT IV **7 Hours**

Clinical trials

Developing clinical trial protocols, (2 hrs)
Institutional Review Board / Independent Ethics committee - formation and working procedures (1hr)
Informed consent process and procedures, (1hr)
GCP obligations of Investigators, (1hr)
Sponsors & Monitors, Managing and Monitoring clinical trials, (1hr)
Pharmacovigilance – safety monitoring in clinical trials(1hr)

TEXT BOOKS:

1. J. Pisano, David Mantus. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Doug-las. (Latest edition)
2. The Pharmaceutical Regulatory Process, 2nd edn Edited by Ira R. Berry and Robert P.Martin,Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers. (Latest edition)
3. Vyawahare NS, Itkar S. Drug Regulatory Affairs, Nirali Prakashan Pune, 2019.

REFERENCE BOOKS:

1. Anthony C. Cartwright, Brian R. Matthews, International Pharmaceutical Product Registration, CRC Press, 2016.
2. Kanfer I, Shargel L, Generic Drug Product Development, International Regulatory Requirements for Bioequivalence, Taylor and Francis, 2019.

** latest edition of text books & reference books can be reffered.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Pharmacovigilance (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP708ET**

SCOPE: This course highlights the activities related to understanding, assessment, detection, and prevention of adverse effects or any other drug-related problems. Transforming the knowledge on the widening scope of pharmacovigilance inclusive of Haemovigilance, Materiovigilance and adverse drug reactions (ADRs) to be provided to regulators, clinicians, and patients.

This course also aimed to observe adverse drug reactions (ADRs) in the real-world setting and evaluate the impact of the pharmacist's role on ADR monitoring and reporting to improve patient safety. The course urges more collaboration between concerned parties to strengthen the clinical application of pharmacovigilance and market this fundamental process in drug development, post-marketing, and patient health outcome. Support other healthcare professionals in educating society. Follow the International Council for Harmonization (ICH) guidelines for pharmacovigilance.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Define and classify the adverse drug reactions.
K2: Discuss the Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India and compare the national and international scenarios of pharmacovigilance.
K3: Describe safety data generation in the pre-clinical phase, clinical phase and post-approval phases
K4: Assess the drug safety evaluation in special population (Pediatrics, Pregnancy and lactation, geriatrics)
K5: Illustrate the drug dictionaries, and basic terminologies used in pharmacovigilance
K6: Explain the vaccine pharmacovigilance and adverse events following immunization.

SKILLS

S1: Interpret the Adverse drug reactions from given data
S2: Estimate the safety information on use of medicines to various stakeholders to minimize the risk
S3: Demonstrate the Drug dictionaries and coding in Pharmacovigilance

S4: Evaluate the Vaccine safety surveillance
S5: Perform effective communication skills in Pharmacovigilance
S6: Predict genetic related adverse drug reactions

ATTITUDE

A1: Praise the role of Pharmacovigilance program in India and at the global level
A2: Appriciate the reporting culture amongst healthcare professionals
A3: Participate in Pharmacovigilance awareness program in India
A4: Recognize other healthcare professionals in educating society
A5: Follow the International Council for Harmonization (ICH) guidelines for pharmacovigilance
A6: Support regulatory agencies in the decision-making process on use of medications

COURSE CONTENTS

UNIT I 6 Hours

Introduction to Pharmacovigilance
History and development of Pharmacovigilance, Importance of safety monitoring of Medicine. (1hr)
WHO international drug monitoring programme, Pharmacovigilance Program of India (PvPI). Cosmetovigilance, Materiovigilance and Haemovigilance. (1hr)
Introduction to adverse drug reactions
Definitions and classification of ADRs, Mechanism of adverse drug reactions.(1hr)
Detection and reporting, Methods in Causality assessment, Management of adverse drug reactions(1hr)
Severity and seriousness assessment, Predictability and preventability assessment (1hr)
Basic terminologies used in pharmacovigilance
Terminologies of adverse medication related events, Regulatory terminologies(1hr)

UNIT II 7 Hours

Drug and disease classification
Anatomical, therapeutic and chemical classification of drugs, International classification of diseases, Daily defined doses ,International Nonproprietary Names for drugs(1hr)
Drug dictionaries and coding in pharmacovigilance
WHO adverse reaction terminologies, MedDRA and Standardized MedDRA queries, , Eudravigilance medicinal product dictionary. (WHO drug dictionary)(1hr)
Information resources in pharmacovigilance
Specialized resources for ADRs, Basic drug information resources (1hr)
Establishing pharmacovigilance program

Establishing in a hospital , Establishment & operation of drug safety department in industry(1hr) Contract Research Organizations (CROs) , Extending to nationwide Primary Health care and Sensitising community Pharmacies. .(1hr)

Software's in Pharmacovigilance

Argus, Aris G and VigiFlow `

World Health Organization (WHO)-Uppsala Monitoring Centre(1hr)

VigiBase, VigiLyze, VigiAccess, VigiFlow

vigiGrade, vigiMatch and vigiRank(1 hr)

UNIT III **7 Hours**

Vaccine safety surveillance

Vaccine Pharmacovigilance, Vaccination failure and adverse events following immunization. (2hr)

Pharmacovigilance methods

Passive surveillance – Spontaneous reports and case series, Stimulated reporting, Active surveillance – Sentinel sites, drug event monitoring and registries (2hr)

Comparative observational studies – Cross sectional study, case control study and cohort study, Targeted clinical investigations (2hrs)

Communication in pharmacovigilance

Communication in Drug Safety Crisis management,Communicating with Regulatory Agencies(1hr)

Business Partners, Healthcare facilities & Media, Effective communication in Pharmacovigilance(2hrs)

UNIT IV **5 Hours**

Safety data generation

Pre-clinical phase, Clinicalphase and Post-approval phases (PMS)(1hr)

ICH Guidelines for Pharmacovigilance

Organization and objectives of ICH, Expedited reporting(1hr)

Individual case safety reports ,Periodic safety update reports(1hr)

Post approval expedited reporting, Pharmacovigilance planning (1hr)

Good clinical practice in pharmacovigilance studies (1hr)

Unit V **3 Hours**

Pharmacogenomics of adverse drug reactions

Genetics-related ADR with example focusing PK parameters, Polymorphism in genes encoding pharmacodynamics parameters and ADRs(1hr)

Drug safety evaluation in special population

Geriatrics, Renal & Hepatic dysfunction, Paediatrics ,Pregnancy and lactation(1hr)

CIOMS

CIOMS Working Groups ,CIOMS Form

CDSCO (India) and Pharmacovigilance

D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements(1hr)

UNIT VI **2 Hours**

WHO guidelines on safety monitoring of traditional and herbal medicines in pharmacovigilance systems

Pharmacovigilance of herbal drugs: Definition of traditional and herbal drugs, Challenges relating to the safety monitoring of herbal drugs(1hr)

Mechanisms underlying ADR due to traditional and herbal drugs(1hr)

TEXT BOOKS:

1. Andrews, E. B., Moore, N. Mann's Pharmacovigilance. 3rd edn. Wiley-Blackwell; New Jersey: 2014.
2. Parthasarathi G, Karin N H, Milap C N. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 2nd edn.: Orient Longman Private Limited; Chennai. 2012.

REFERENCE BOOKS:

1. Waller, P., Harrison-Woolrych, m. An introduction to Pharmacovigilance. 2nd edn. Wiley-Blackwell; New Jersey:2017.
2. Barton, C., Biron, P. Practical Drug Safety from A to Z. 1st edn. Jones & Bartlett Publishers; Massachusetts: 2017.
3. Barnes J, editor. Pharmacovigilance for Herbal and Traditional Medicines: Advances, Challenges and International Perspectives. Springer Nature; 2022.

ONLINE SOURCES:

1. World Health Organization. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems. World Health Organization; 2004.
2. World Health Organization (WHO)-Uppsala Monitoring Centre.

** latest edition of text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Quality Control and Standardization of Herbal Products (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP711ET**

SCOPE: In this course students will be introduced to the regulatory frameworks and quality assurance standards applicable to the herbal industry. They will learn about good manufacturing practices (GMP), quality control, product safety, labeling requirements, and compliance with relevant laws and regulations. They learned about the various methods and guidelines for evaluation and standardization of various herbs and herbal products. It enables students to compare the various analytical techniques in standardization of herbal products. The course deals with WHO Guidelines on current good manufacturing practices (cGMP) and good agricultural and collection practices (GACP) for medicinal plants.

The course provides a comprehensive understanding of stability testing of herbal products. The course provides an opportunity to compare EU and ICH guidelines for quality control of herbal products. It also outlines the documentation for new drug application and export registration. This course is designed to equip students with the necessary skills and knowledge to excel in both the herbal industry and regulatory sectors, with a particular emphasis on fostering ethics and responsibility.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course the student shall be able to

KNOWLEDGE

K1: Describe the guidelines for quality control of herbal products and evaluation of safety and efficacy of herbal products.
K2: Explain Drugs and Cosmetic Act Provision for herbal products preparation and marketing.
K3: Describe the preparation of documents for new drug application and export registration.
K4: Discuss the research guidelines for evaluating the efficacy of herbal products.
K5: Compare the various analytical techniques in standardization of herbal products.
K6: Assess the regulatory requirements for herbal products.

SKILL

S1: Compare EU and ICH guidelines for quality control of herbal drugs
S2: Evaluate the quality control procedures for standardization of herbal products.

S3: Conclude different regulatory requirements for herbal products.
S4: Summarize WHO Guidelines on good agricultural and collection practices (GACP) for medicinal plants.
S5: Compare various Herbal Pharmacopoeias.
S6: Analyze the role of chemical and biological markers in standardization of herbal products.

ATTITUDE

A1: Appreciate diverse perspectives, ideas, and cultures.
A2: Participate actively in discussions.
A3: Accept responsibility.
A4: Develop time management skills.
A5: Appreciate the teamwork and interdisciplinary cooperation.
A6: Cultivate critical thinking skills.

COURSE CONTENTS

UNIT I — 7 Hours

Basic tests for drugs – Pharmaceutical substances (2 hrs)
Medicinal plants materials and dosageforms (2 hrs)
WHO guidelines for quality control of herbal drugs.(2 hrs)
Evaluation of commercial crude drugs intended for use (1 hr)

UNIT II — 7 Hours

Quality assurance in herbal drug industry of cGMP, GAP, GMP. (2 hrs)
GLP in traditional system of medicine.(1 hr)
WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines(3 hrs)
WHO Guidelines on GACP for Medicinal Plants.(3 hrs)

UNIT III — 6 Hours

EU and ICH guidelines for quality control of herbal drugs.(3 hrs)
Research Guidelines for Evaluating the Safety and Efficacy of Herbal products. (3 hrs)

UNIT IV — 5 Hours

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.(2 hrs)
Preparation of documents for new drug application and export registration. (1 hr)
GMP requirements and Drugs & Cosmetics Act provisions.(2 hrs)

UNIT V **5 Hours**

Regulatory requirements for herbal products.(1 hr)
WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems (1 hr)
Comparison of various Herbal Pharmacopoeias.(1 hr)
Role of chemical and biological markers in standardization of herbal products (2 hrs)

TEXT BOOKS:

1. Mukherjee PK. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. 1st edn. Business Horizons Publishers; New Delhi: 2002.
2. Agrawal SS, Paridhavi M, Herbal drug technology. 2nd ed. Universities Press; Hyderabad:2002.
3. Indian Drug Manufacturers Association. Indian Herbal Pharmacopoeia. Indian Drug Manufacturers Association; Mumbai: 2002.

REFERENCE BOOKS:

1. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, Manila: WHO Regional office for the Western Pacific.(Latest).
2. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. Geneva: World Health Organization.(Latest)

ADDITIONAL READING MATERIALS

1. Kunle OF, Egharevba HO, Ahmadu PO (2012). Standardization of herbal medicines - A review. *Int J Biodivers Conserv*. 4: 101-112.
2. EMA Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products.(Latest)
3. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization. Geneva.(Latest)

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Computer Aided Drug Design (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP707ET**

SCOPE: This course is designed to provide fundamental knowledge of the rational drug design process and computer-assisted drug design. It also covers the various strategies for developing drug-like molecules using molecular docking and 2D-QSAR techniques.

The course covers analogue drug design and bioisosteric replacement. Case studies of docking, 2D-QSAR, ADME prediction and De novo drug design. The syllabus also emphasizes the introduction to molecular mechanics, quantum mechanics and different types of energy minimisation methods.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to:

KNOWLEDGE

K1: Describe the discovery of lead molecules (Remembering).
K2: Explain the basic principles and parameters used in QSAR (Comprehension).
K3: Apply the basic concept of molecular docking with examples (Application).
K4: Determine the ADME properties of drug-like molecules (Analysis).
K5: Categorize the different types of bioisosteric replacement (Synthesis).
K6: Predict the pharmacophore mapping (Evaluation).

SKILL

S1: Demonstrate the difference between rigid and flexible docking.
S2: Calibrate the 2D-QSAR equations of different classes of compounds.
S3: Operate with various strategies to develop new drug-like molecules.
S4: Detect the binding energies of different classes of molecules by docking.
S5: Estimate the different energy minimization methods in molecular modelling.
S6: Demonstrate the De novo drug designing by using CADD software.

ATTITUDE

A1: Appreciate the role of CADD in drug discovery and healthcare
A2: Participate in cultivating a data-driven approach.
A3: Embrace a mind set of a continuous learning process
A4: Recognise the importance of artificial intelligence in modern drug design and development.
A5: Develop the interdisciplinary mind set
A6: Work as a team and complete the tasks on time.

COURSE CONTENTS:

UNIT – I **4 Hours**

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine**,** Random screening, Non-random screening, Serendipitous drug discovery, Lead discovery based on drug metabolism**,** Lead discovery based on clinical observation successful (2hrs)

Analog-Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement
Case studies (2hrs)

UNIT – II **8 Hours**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR (1hr)

History and development of QSAR, Types of parameters used in QSAR (4 hrs)

Hansch analysis and Free Wilson analysis (3 hrs)

UNIT – III **8 Hours**

Molecular Modeling and virtual screening techniques

Virtual Screening Techniques:

Drug likeness screening (1hr)

Concept of pharmacophore mapping and pharmacophore-based Screening (3hrs)

Molecular docking:

Rigid docking, Flexible docking, manual docking, Applications (2hrs)

De novo drug design. (2hrs)

UNIT – IV **5 Hours**

Informatics & Methods in drug design

Introduction to Bioinformatics and chemoinformatics (2hrs)

ADME databases(2hrs)

Pharmaceutical databases (1 hr)

UNIT – V **5 Hours**

Molecular Modelling

Introduction to molecular mechanics and quantum(2hrs)

Energy Minimization methods (2hrs)

Global conformational minima determination(1 hr)

TEXT BOOKS:

1. Foye, William O, Thomas L. Lemke, and David A. Williams. Foye, William O, Thomas L. Lemke, and David A. Williams, Foye's Principles of Medicinal Chemistry. MLA, 7th edn. Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia, 2013.
2. Wilson, C. O., Beale, J. M., & Block, J. H. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry 12th edn. MD: Lippincott Williams & Wilkins, Baltimore,2011
3. Silvermann R.B. The Organic Chemistry of Drug Design and Drug Action.2nd edn. Academic Press; 2005.
4. Patrick G. L. An Introduction to Medicinal Chemistry, 4th edn. Oxford University Press: New York; 2009.

REFERENCE BOOKS:

1. Stroud. R.M, Finer-Moore J. Computational and structural approaches to drug discovery: ligand-protein interactions. 1st edn: Royal Society of Chemistry: Cambridge; 2008.
2. Hansch. C. Comprehensive Medicinal Chemistry, Vol 1-6,1st edn: Re. Pergamon Press: England; 2005
3. Martin. Y.C. Quantitative Drug Design: A Critical Introduction, 2nd edn: CRC Press; New York; 2010.
4. Abraham, Donald J. Rotella David P. Burger Alfred, "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry", Vol I to V, New York: John Wiley & Sons, 2021.

** latest edition of text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Cell and Molecular Biology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP709ET**

SCOPE: The course is designed to impart knowledge on the interactions between the various systems of a cell, including the interactions between DNA, RNA, and protein biosynthesis, and studies of how these interactions are regulated in inflammation and cancer. It also describes the flow of genetic information in cells, DNA replication, and coding for the RNA through the transcription process, and further RNA codes for the proteins by translation.

The course also includes major pathways involved in inflammation, cancer, and neurodegenerative disease pathophysiology. In addition, fundamental techniques of cell culture studies are involved in the proper understanding of cellular events. It also encompasses Cell-based assays for cell viability studies, cell cycle analysis, and apoptosis, widely used in basic and translational research as cost-effective and accessible models to mimic *in vivo* responses. This course enables the students to succeed in diverse career paths in the pharmaceutical as well as biotechnological sectors with an emphasis on creativity, confidence, ethics and responsibility.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Discuss the history and development of Cell and Molecular biology research (Understanding)

K2: Explain the central dogma of molecular biology in the conventional and modern eras. (Understanding)

K3: Describe the cellular process, cellular pathways, and cell cycle events. (Understanding)

K4: Compare the concept of transcription and translation in Eukaryotes and Prokaryotes (Understanding)

K5: Distinguish the concept of DNA replication in Eukaryotes and Prokaryotes (Understanding)

K6: Demonstrate the procedures in animal cell maintenance (Applying)

SKILL

S1: Demonstrate the different cell organelles in a eukaryotic cell.

S2: Identify the key regulatory protein involved in support of the chromosome.

S3: Detect the different cell organelles in a eukaryotic cell.

S4: Illustrate the cellular events in the mitotic division.

S5: Outline the different phases of the cell cycle in a set of cell populations by flow cytometry.

S6: Assess the apoptotic phase of the cells using flow cytometry.

ATTITUDE

A1: Think critically and apply innovative solutions to challenges.

A2: Develop the ability to interact effectively and respectfully with individuals from diverse cultural backgrounds.

A3: Participate autonomously in a technical and supervisory context**.**

A4: Accept responsibility for self and group work**.**

A5: Follow personal values and apply ethical principles in professional and social contexts.

A6: Embrace knowledge for sustainable development.

COURSE CONTENTS:

UNIT I

Central Dogma of molecular biology **12 Hours**

Cell and Molecular Biology: History and application (1hr)

Basic concepts of the structure of Prokaryotic versus Eukaryotic cells, Properties of cell and cell membrane DNA and RNA and their structures, and Proteins and their structure (1hr)

DNA Replication in eukaryotes. Differentiate from Prokaryotes (1hr)

Types of RNA & mRNA processing. Structure and function of different types of RNA. The process involved in alternate splicing (1hr)

Transcription: steps involved in Eukaryotic transcription, different types of RNA polymerases and their function(2hrs)

Compare and contrast with transcription in Prokaryotes, the post-transcriptional modifications (2hrs)

Translation: Steps in protein translation, genetic code, the significance of protein synthesis(2hrs)

Compare and contrast with the prokaryotic system, post-translational modifications (2hrs)

UNIT II

Signal transduction **8 Hours**

Cell Signals: Definition of cell signals, cell surface receptors and signal transduction with suitable examples (3hrs)

Signaling Pathways: Enlist the major pathways in Inflammation, cancer and neurodegenerative disease(2hrs).

Misregulation of Signaling Pathways in - NF-κB, MAPK, and JAK-STAT and P53 mediated pathway (3hrs)

UNIT III

Animal Cell culture **10 Hours**

Growth of animal cells in culture: Characteristics of cultured cells, Physicochemical properties of culture media, Maintenance of subculture as monolayer cultures and suspension cultures, General procedure for maintaining cell cultures the techniques of primary culture as mechanical disaggregation and enzymatic disaggregation. (3hrs)

2D and 3D Cell Culture: development, challenges, and future trends (3hrs)

Principles of cell viability assay- based on membrane integrity and cell survival (2hrs)

Cell cycle analysis & Apoptosis: Measurement of apoptosis and autophagy (2hrs)

TEXTBOOKS:

1. Kokate C. Textbook of pharmaceutical biotechnology. 1st edn, Elsevier, India; 2011.
2. Dwivedi S. Concise course in cell and molecular biology. 1st edn, S Vikas and Company (PV), Punjab; 2019.
3. Glick,Bernard R and Patten,Cheryl L. Molecular biotechnology:principles and applications of recombinant DNA.5th edn, ASM press, Washington D.C; 2010

REFERENCE BOOKS:

1. Lodish, Harvey. Molecular Cell Biology. 7th edn, W H Freeman & Co., New York;2012
2. Davis,J M. Basic Cell Culture.2nd edn, Oxford University Press, London;2005
3. Dubey,R C. A textbook of biotechnology,5th edn, S Chand Publishers, Delhi; 2014.

JOURNALS:

1. BMC Molecular and Cell Biology https://bmcmolcellbiol.biomedcentral.com/
2. Nature Reviews Molecular Cell Biology https://www.nature.com/nrm/
3. Molecular and Cellular Biology https://www.tandfonline.com/journals/tmcb20
4. Molecular Cell https://www.cell.com/molecular-cell/home

**The latest edition of text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Cosmetic Science (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP706ET**

SCOPE: This course is designed to impart knowledge and skills necessary for the fundamental need of cosmetic and cosmeceutical products. It also provides a foundation to understand the current and future advancement in cosmetics with respect to skin care ingredient technologies, basics of skin care formulation development and essential compliance requirements regarding cosmetic product labels, marketing and product performance claims.The course offers a comprehensive scope in addressing problems associated with skin, hair, and teeth. Students will explore the principles of formulation, focusing on the building blocks of skin, hair, and oral care products. They will learn about the various cosmetic excipients used in these formulations, understanding their functions and compatibility with active ingredients.

The course also covers the specific labeling requirements for these products, ensuring compliance with regulations and providing accurate information to consumers. The students will study the development of cosmetics tailored for babies, taking into account their unique needs and safety considerations. Furthermore, they will delve into the field of herbal cosmetics, exploring natural ingredients and their efficacy in promoting skin, hair, and oral health. Overall, the course equips students with the knowledge and skills necessary to address common skin, hair, and teeth problems, show enthusiasm for exploring novel and effective cosmetic products, meet regulatory standards, and cater to diverse consumer needs in the realm of cosmetics and cosmeceuticals.

COURSE LEARNING OUTCOMES

Upon successful completion of the subject student shall be able to;

KNOWLEDGE

K1: Explain the fundamental concepts and terminologies related to cosmetic science.

K2: Describe the principles and theories underlying various cosmetic formulations and their applications.

K3: Identify the key ingredients used in cosmetics and cosmeceuticals.

K4: Apply the acquired knowledge to analyze and solve practical problems in cosmetic formulation and development.

K5: Analyze the various parameters affecting the efficacy of cosmetic products.

K6: Evaluate the regulatory requirements and guidelines governing the manufacturing, labeling, and safety assessment of cosmetic products.

SKILL

S1: Apply theoretical concepts to evaluate cosmetic product formulations.

S2: Demonstrate proficiency in interpreting cosmetic product labels.

S3: Use theoretical knowledge to suggest appropriate modifications to improve cosmetic product formulations.

S4: Develop a theoretical understanding of the quality control and quality assurance processes involved in cosmetic product manufacturing.

S5: Identify basic laboratory skills and techniques required for cosmetic science, such as accurate measurement, mixing, and basic product testing.

S6: Display proficiency in cosmetic product development and its optimization.

ATTITUDE

A1: Embrace a collaborative mindset, actively engaging in discussions and teamwork to foster innovation and share ideas.

A2: Develop an appreciation for the importance of safety and quality in a formulation and manufacturing set up.

A3: Cultivate a curious and inquisitive mindset, actively seeking new knowledge and understanding of scientific principles and advancements .

A4: Show enthusiasm for exploring novel formulation approaches.

A5: Display a proactive approach to problem-solving, embracing challenges and propose effective solutions.

A6: Exhibit self-motivation and the ability to engage in self-directed learning.

COURSE COTENTS

UNIT I **6 Hours**

Introduction to cosmetics: Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations

Evolution of cosmeceuticals from cosmetics (1hr).

Skin: Basic structure and function of skin(1hr).

Hair: Basic structure of hair. Hair growth cycle(1hr)

Oral Cavity: Common problem associated with teeth and gums(1hr).

Cosmetic excipients:

Surfactants

Rheology modifiers

Humectants

Emollients

Preservatives

Classification and application(2hrs)

UNIT II **8 Hours**

Principles of formulation and building blocks of skin care products and its labelling requirements:

Face wash, Moisturizing cream, Cold Cream,Vanishing cream and their advantages and disadvantages

Application of these products in formulation of cosmeceuticals (2hrs)

Antiperspants & deodorants- Actives & mechanism of action (1hr)

Principles of formulation and building blocks of Hair care products and its labelling requirements:

Conditioning shampoo, Hair conditioner, Anti-dandruff shampoo

Hair oils, Chemistry and formulation of Para-phylene diamine based hair dye (2hrs).

Principles of formulation and building blocks of oral care products and its labelling requirements:

Toothpaste for bleeding gums,Sensitive teeth (2hrs), Tooth pase for Teeth whitening Mouthwash (1hr).

UNIT III **6 Hours**

Sun protection

Sun protection and its importance(1hr)

Classification of Sunscreens with suitable examples and its labelling requirements

Sun Protection Factor (SPF)and its significance(1hr).

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric (1hr)

Hair care: Henna and amla

Oral care: Neem and clove(1hr)

Analytical cosmetics:

BIS specification and analytical methods for shampoo (1hr)

Skin cream and toothpaste(1hr)

UNIT IV **4 Hours**

Principles of Cosmetic Evaluation:

Principles of sebumeter(1hr)

Principles of Corneometer

Measurement of TEWL(1hr)

Skin Color

Hair tensile strength

Hair combing properties(1hr)

Soaps and syndet bars(1hr).

UNIT V **6 Hours**

Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes(1hr)

Cosmetic problems associated with skin: Wrinkles, acne, prickly heat and body odor.

Basic understanding of the terms- Comedogenic and Dermatitis(2hrs).

Cosmetic Products for Babies:

Introduction, skin problems in babies, requirement of baby products (1hr)

Safety aspects of baby products, examples, formulations, labels etc (2hrs).

TEXT BOOKS:

1. J.B. Wilkinson. Harry's Cosmeticology. 9th edn, Chemical Publishing Co.USA.2015.
2. W. A.Poucher. Perfumes, Cosmetics and Soaps. 10th edn, Chapman and Hall, London. 2000.
3. P. P. Sharma. Cosmetics : Formulation, Manufacturing & Quality Control. 6th edn, Vandana PublicationsPvt. Ltd., Delhi. 2021.

REFERENCE BOOKS:

1. S. Sharma , N. Sharma , P. Gaba. Cosmetics and Cosmeceuticals. 1st edn, Nirali Prakashan. Delhi. 2022.
2. H. A. E. Benson, M. S. Roberts. Cosmetic Formulation Principles and Practice.CRC Press, USA.2019.
3. O. Barel, M. Paye, H. I. Maibach. Handbook of Cosmetic Science and Technology.CRC Press, USA.2014.
4. B.M. Mithal, R.N.Saha.Hand book of Cosmetics. 1st edn, Vallabh Prakashan, Delhi. 2013.

JOURNALS:

1. Cosmetics (Publisher- MDPI publishers).
2. International Journal of Cosmetic Science. (Publisher-The Society of Cosmetic Chemist's Journal of Cosmetic Science).
3. Journal of Applied Cosmetology (Publisher: International Ediemme).

**The latest edition of text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Preclinical Pharmacology (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP710ET**

SCOPE: This course is designed to impart knowledge on the various guidelines for the maintenance, breeding and conduct of experiments in laboratory animals. It helps to give an insight into the *in vivo* preclinical evaluation of drugs and recent experimental techniques in drug discovery and development. Moreover, it helps in calculating the dose of drugs required for animal experimentation and justifying the method required for tissue sampling and analysis.

The course helps in predicting suitable animal models for the screening of drugs. It helps the student to understand the planning and execution of various *in-vivo* preclinical evaluations. Additionally, it helps in pursuing careers in academia and conducting research to expand knowledge in pharmacology.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the students shall be able to;

KNOWLEDGE

K1: Outline the various guidelines for the maintenance, breeding and conduct of experiments in laboratory animals
K2: Describe the various animal models to screen various drugs
K3: Identify the type and number of animals required to conduct the screening of a test substance
K4: Explain the use of various animals used in the experimental pharmacology
K5: Calculate the dose of drugs required for animal experimentation
K6: Justify the method required for tissue sampling and analysis.

SKILL

S1: Rationalize the use of various animal models in the screening of drugs
S2: Predict the suitable animal models for the screening of drugs.
S3: Recommend the appropriate standard drugs used for comparing the action of novel molecules
S4: Develop SOPs for carrying out experimentation on animals
S5: Plan and validate animal experimentation according to the GLP guidelines
S6: Identify the behavioural changes in animals during the screening of various drugs

ATTITUDE

A1: Appreciate the knowledge of Pharmacology for developing new animal models.
A2: Communicate effectively with peers and others
A3: Support and collaborate with others.
A4: Exhibit professionalism in the work environment.

A5: Participate actively in workshops to improve knowledge
A6: Embrace newer advancements in the healthcare system.

COURSE CONTENTS

UNIT I **6 Hours**

Introduction to Preclinical screening models

In vitro and Alternative preclinical models (1hr)

CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments in laboratory animals (2hrs)

Dose selection, Calculation and conversions (1hr)

Preparation of drug solution/suspensions (1hr)

Grouping of animals and the importance of sham negative and positive control groups, the rationale for selecting animal species and sex for the study (1hr)

UNIT II **5 Hours**

Tissue processing techniques for various evaluations (1hr)

Tissue-based evaluation and criteria behind tissue selection (1hr)

Types of studies conducted on animals. (Emphasis on drug screening studies, toxicity studies, and safety pharmacological studies) (2hrs)

Need for transgenic animals and their application (1hr)

UNIT III **5 Hours**

In-vivo screening of;

analgesics (1hr)

Antipyretics (1hr)

Behavioural studies in animals (2hrs)

Nootropics (1hr)

UNIT- IV **5 Hours**

In-vivo screening of;

Antiepileptics (1hr)

Antipsychotics (1hr)

Anti-Parkinson's agents (1hr)

Anti-Alzheimer's disease (1hr)

Anti-Multiple Sclerosis (1hr)

UNIT V **4 Hours**

In-vivo screening of;

Antihypertensives (1hr)

Diuretics (1hr)

Antiarrhythmics (1 hr)

Hypolipidemics (1 hr)

UNIT VI **5 Hours**

In-vivo screening of;
Antiulcer agents (1hr)
Anti colitic agents (1hr)
Antidiabetics (1hr)
Anticancer (1hr)
Anti-arthritic agents (1hr)

TEXTBOOKS:

1. Arunachalam K, Sasidharan SP. Bioassays in Experimental and Preclinical Pharmacology. 1st edn. Springer Nature, New York, USA. 2021.
2. Ghosh MN. Fundamentals of Experimental Pharmacology. 7th edn. Hilton & Company, India. 2019.

REFERENCE BOOKS:

1. Hock FJ (Eds.). Drug Discovery and Evaluation: Pharmacological Assays, 4th edn. Springer International Publishing. Switzerland: 2016
2. Gupta SK. Drug Screening Methods. 3rd edn., Jaypee Brothers Medical publishers(P) Ltd. New Delhi. India: 2016.

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Dietary Supplements and Nutraceuticals (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP712ET**

SCOPE: The course is designed to impart knowledge on dietary supplements and nutraceuticals and their impact on chronic disease prevention. It also discusses important marketed dietary supplements, nutraceuticals, and functional foods that can be appropriately used to improve health and well-being. It also covers the occurrence, chemical features and medicinal benefits of phytochemicals of nutraceutical relevance. It also details the role of nutraceuticals in intestinal health and mental health.

Free radicals' impact on chronic disease and their management with antioxidants are also discussed. It also focuses on Public health nutrition, maternal and child nutrition, nutrition and ageing, and nutrition education in the community. The regulatory aspects of challenges associated with the marketing of nutraceuticals and dietary supplements are also highlighted. This course ensures a participatory role as responsible citizens and facilitates improvement in health and well-being.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Explain the need for dietary supplements to maintain healthy life (Understanding)
K2: Discuss the marketed nutraceuticals with their positive health outcome. (Understanding)
K3: Describe the occurrence, chemical features, and medicinal benefits of phytochemicals of nutraceutical relevance (Understanding)
K4: Outline the regulatory and commercial aspects of dietary supplements (Understanding)
K5: List phytochemicals as nutraceuticals and their scope in chronic disease prevention. (Understanding)
K6: Illustrate the pharmacopoeia specifications for dietary supplements and nutraceuticals. (Understanding)

SKILL

S1: Identify the metabolites of the nutritional component or nutraceuticals.
S2: Demonstrate the preparation of nutraceuticals.
S3: Assess the risk factors for approval of nutraceuticals in the Indian, US, and European markets.

S4: Detect the limitations of marketed nutraceuticals.
S5: Analyze the environmental factors affecting the potential of nutraceuticals.
S6: Measure the antioxidant enzyme level in diseased as well as treated conditions.

ATTITUDE

A1: Upgrade technical, intellectual, and emotional skills and facilitate improvement.
A2: Develop the ability to interact effectively and respectfully with individuals.
A3: Participate autonomously in a technical and supervisory context.
A4 : Accept responsibility for self and group work.
A5: Implement plans and organize work to meet deadlines.
A6: Appreciate collaborative skills to work effectively in interprofessional healthcare teams.

COURSE CONTENTS

UNIT I 12 Hours

Nutraceuticals in human disease

Definitions of Functional foods, Nutraceuticals and Dietary supplements with suitable examples & available marketed products for chronic disease prevention (3 hrs)
Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following:
Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin (2hrs)
Sulfides: Diallyl sulfides, Allyl trisulfide. (1hr)
Polyphenolics: Reserve tool (1hr)
Flavonoids- Rutin, Naringin, Quercitin, Anthocyanidins, Catechins, Flavones (2hrs)
Prebiotics / Probiotics: Fructo-oligosaccharides, *Lacto bacillum* (1hr)
Role of nutraceuticals in intestinal health and mental health (2hrs)

UNIT II 12 Hours

Free radicals and human disease

Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, and nucleic acids. (2hrs)
Free radicals in Diabetes mellitus, Inflammation, Cancer, and CVD (4hrs)
Free radicals in brain metabolism and pathology, kidney damage, and liver damage (2hrs)
Free radical's theory of aging. (1hr)
Antioxidants: Endogenous antioxidants – enzymatic and non-enzymatic antioxidant defense, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione, Vitamin C, Vitamin E, α- Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxyl Toluene, Butylated hydroxyl Anisole (3hrs)

UNIT III

Nutrition in Health and its regulatory aspects **6 Hours**

Regulatory Aspects: The regulatory issues of Nutraceuticals and Dietary Supplements as per EU, US, and Indian guidelines. FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. (3hrs).

Pharmacopoeia Specifications for dietary supplements and nutraceuticals. (1hr)

Effect of processing, storage, and interactions of various environmental factors on the potential of nutraceuticals. (1hr)

Public health nutrition, maternal and child nutrition, nutrition and aging, and nutrition education in the community. (1hr)

TEXTBOOKS:

1. Srilakshmi B, Dietetics. 6th edn, New Age International Publisher, New Delhi; 2017.
2. Shilpa MA, et al.,A text book of dietary supplements and nutraceuticals. 1st edn, S Vikas and Company (PV),Punjab; 2019.
3. Robert E.C. Wildman, Robert Wildman, Taylor C. Wallace Handbook of Nutraceuticals and Functional Foods. 3rd edn; CRC Press, United States; 2006.

REFERENCE BOOKS:

1. Gibson GR &William CM. Functional Foods: Concept to Product. 1stedn. London: Woodhead Publication Co.; 2000
2. Cooper K.A. Advanced Nutritional Therapies. 1st edn.. USA Thomas Nelson Inc;1997
3. Agusti K.T., Faizal P., Role of Dietary fibers and nutraceuticals in preventing diseases.1st edn. India. BSP Books. 2019.

JOURNALS:

1. Journal of Food Science and Technology https://www.springer.com/journal/13197
2. Food Science and Nutrition https://onlinelibrary.wiley.com/page/journal/20487177/homepage/publishing_with_food_science___nutrition.htm
3. Nutrients https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7352266/
4. Journal of Functional Food https://www.sciencedirect.com/journal/journal-of-functional-foods

**Latest edition of the text books & reference books can be referred*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Life Skills III (T)	**2**	**0.5**	**0**	**30**	**2.5**	**VII**	**BP713T**

SCOPE: Life Skills training envisages to equip students with essential skills to conduct and perform better in their personal and professional life. Life Skills III is the third level course for the UG students, and it consists of three components namely Soft Skills, Aptitude Skills, and Verbal Skills. The topics covered include teamwork, leadership, facing interview, stress management, geometry, permutation & combination, probability, statistics, vocabulary, reasoning, reading comprehension, and writing.

COURSE LEARNING OUTCOMES

CO1: Soft Skills - To acquire the ability to work in teams, present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.
CO2: Soft Skills - To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.
CO3: Aptitude - To manage time while arriving at appropriate strategies to solve questions in geometry, statistics, probability and combinatorics.
CO4: Aptitude - To analyse, understand and apply suitable methods to solve questions on logical reasoning and data analysis.
CO5: Verbal - To use diction that is less verbose and more refined and to use prior knowledge of grammar to correct/improve sentences.
CO6: Verbal - To understand arguments, analyse arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.
Skills: Communication, teamwork, leadership, facing interviews and problem-solving.

COURSE CONTENTS:

SOFT SKILLS **15**

Teamwork 4

Definition of a team, value of teamwork in organizations, effective team-building, parameters for a good team, roles, empowerment and need for transparent communication, factors affecting team effectiveness, personal characteristics of members and its influence on team.

Team problem solving activities to demonstrate the process and dynamics of team work. Every team member participates in team problem solving activity.

Leadership 3

Role of leadership in team performance. Internal problem solving, growth and productivity, evaluation and co-ordination. Demonstrations, case studies and activities.

CV Preparation 2

Preparation of an industry relevant CV and reviewing the same.

Stress Management 3

The causes of stress and different types of stressors, different stressors in medical profession / reference to the pharma profession, identifying stressors in an individual, the process of stress, effective ways of managing stress.

Activities to measure individual stressors. Brain storming and discussions.

Facing Interview 1

Purpose of job interview, types of job interviews, how to prepare for an interview, dos and don'ts of interview.

Mock Interview 2

Few practice sessions in the class and one on one sessions outside the class hours.

APTITUDE SKILLS **15**

Geometry 3

Coordinate geometry, and heights & distance.

Permutations & Combinations 3

Basics, fundamental counting principle, circular arrangements, and derangements.

Probability 2

Basics, addition & multiplication theorems, conditional probability, and Bayes' Theorem.

Statistics 1

Mean, median, mode, range, and standard deviation.

Logical Reasoning 4

Blood relations, direction test, syllogisms, series, odd man out, coding & decoding, cryptarithmetic problems and input-output reasoning.

Campus Recruitment Papers 2

Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.

VERBAL SKILLS **15**

Vocabulary 2

Create an awareness of using refined language through idioms and phrasal verbs.

Reasoning Skills 4

Facilitate the student to tap his reasoning skills through syllogisms, and critical reasoning arguments.

Reading Comprehension (Advanced) 2

Enlighten students on the different strategies involved in tackling reading comprehension questions.

Public Speaking Skills 3

Empower students to overcome glossophobia and speak effectively and confidently before an audience.

Writing Skills 2

Introduce formal written communication and keep the students informed about the etiquettes of email writing.

Versant Model Test 2

REFERENCE BOOKS

1. Adair. J., (1.986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
2. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
3. The Hard Truth about Soft Skills, by Amazon Publication.
4. Verbal Skills Activity Book, CIR.
5. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
16. A Modern Approach to Logical Reasoning, R S Aggarwal.
17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

VALUE ADDED AND SKILL BASED ELECTIVES

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Sanskrit (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM01**

SCOPE : Sanskrit is one of the most ancient and well-preserved Indo-Aryan language. Studying Sanskrit can deepen the linguistic concepts, including phonetics, morphology, syntax, and semantics. It can also help to grasp the intricacies of language evolution and the historical development of Indo-European languages. Sanskrit is renowned for its vast literary corpus, which includes ancient epics, philosophical treatises, plays, poetry, and religious scriptures. Studying Sanskrit helps to gain knowledge about classical Sanskrit literature and develop skills in analyzing and interpreting these texts. This includes understanding literary themes, symbolism, and cultural context.

Many philosophical and religious texts in India, such as the Vedas, Upanishads, Bhagavad Gita, and various commentaries, are written in Sanskrit. Sanskrit is deeply intertwined with Indian culture and history. The knowledge can be particularly useful in fields like anthropology, and historical research. Sanskrit serves as a bridge between various Indian languages and can help to explore linguistic and cultural connections within the Indian subcontinent. The course covers the alphabet, basic grammar, text reading and writing and communication skills in Sanskrit.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, students shall be able to

KNOWLEDGE:

K1 : Identify the alphabets
K2 : Interpret the basics of grammar usage
K3 : Use Sanskrit language to read and write
K4 : Apply Sanskrit language to communicate each other
K5 : Recognize Sanskrit script and pronunciation
K6 : Evaluate the use of Sanskrit

SKILL

S1 : Choose appropriate vocabulary and grammar to communicate effectively
S2 : Assess complex Sanskrit sentences
S3 : Justify the use of Sanskrit numericals.
S4 : Translate words and sentences to Sanskrit
S5 : Recite simple versus
S6 : Acquire the capability of communication in Sanskrit

ATTITUDE:

A1: Accept a positive attitude towards the challenges and complexities of Sanskrit grammar and vocabulary
A2: Participate willingly in language practice activities such as speaking and reciting verses
A3: Cooperate in group discussions of speaking in Sanskrit
A4: Assist in activities to study Sanskrit
A5: Praise the language for its cultural and historical significance
A6: Create an awareness of Sanskrit language among others

COURSE CONTENTS

UNIT I **6 Hours**

Vowels (Swaraaksharaani) Consonants (Vyanjanaaksharaani), Ucharanam (Pronunciation), Conversation (Sambhashanam), Mama Naama, Bhavatah Naama, Bhavatyaah Naama, Numbers (Sankhyaa)- Ekam- Dasha(1-10), Names of things (Vasthoonaam Naamaani) 10 (Show the models of things/ original/ picture and repeat 3,4 times) Eg- Chashakah, Petikaa, Lekhanee, Phalam etc (2 hrs)

Joint Alphabets (Samyuka Aksharaani) Uchaaranam (Pronunciation), Conversation (Sambhashanam) Saha, Saa, Tat (Using Teaching Aids), Asthi, Nasthi, Numbers (Sankhya) Time (Samayah), (5 o'clock , 6,7,8,9,10,11,12,1,2,3,4), Verbs (Kriya Padaani) 10, Gachati, Aagachati, Upavishati, Uthishtati, Padati, Likhati, Khaadati, Pibati, Pashyati, Vadati, Names of things (Vasthoonaam Naamaani) New 10 things, Vasthu Naama Kreedaa – Vocabulary building game (2 hrs)

Varnamaalaa- (Ka, kaa, ki, kee……..) Joint Alphabets (Samyuka Aksharaani) More exercises, Eshah, Eshaa, Etat – (Using Teaching Aids), Numbers – 11-20, Atra, Tatra, Anyatra, Sarvatra, Kutra, Time- 5:15, 5:30, 5:45 (Using Teaching Aid), Verbs (Kriya Padaani), Gachati, Aagachati …..Gachaami, Aagachaami, Upavishaami, Uthishtaami, Padaami, Likhaami, Khaadami, Pibaami, Vadaami, Wishes- Suprabhatam, Su madhyahnam, Subhasaayam, Subharatrihi, Dhanyavaadah, Swaagatham, Kshamyataam, Chintaa maastu, Punar milaamah. (2 hrs)

UNIT II **6 Hours**

Addressing- Shreeman, Mahaashaye , Job (Vrithi Naamani), Chaatrah, Chaatraa, Vaidyah, Vaidyaa, Adhyaapakah, adhyaapikaa, Aarakshakah, Aarakshikaa, Chaalakah, Chaalikaa

Subhashitam 1, Paropakaaraaya Vahanti Nadyah (2 hrs)

Word Splitting,Word Joining,Naama Padaani (Noun)- Kriyapadaani (Verb) – Vaakya Nirmaanam- Sentence Formation (Baalakah Padati),Naama Padaani (Details of Noun),

Linga bhedah (Pullingah, Stree lingah, Napumsaka Lingah) (Masculine Gender, Feminine Gender, Neuter Gender) ,Examples,Relatives- Janakah, Jananee, Sahodarah, Sahodaree, Agrajah, Agrajaa, Anujah, Anujaa,Maatulah,Vachanam- Eka vachanam, Dwi Vachanam,

Bahu Vachanam (Singular, Dual, Plural forms of Noun),Chaatu shlokah- (Riddle), Asthi Nasthi Siro Nasthi,Kathaa (Small story) – Kaakasya Pipaasaa (2 hrs)

Sentence Formation more examples,Gender separation of Non-living objects, Avayavaanaam Naamaani (Names of organs),Samskrita Parichayah- (Vyakaranam, Sahityam, Vedantam, Nyayam),Subhashitam- Ayam Nijah Paro veti (2 hrs)

UNIT III **6 Hours**

Mrigaanaam Pakshinaam Naamaani (Animals and Birds),Kriya padam- Verb,Vachanam – (Singular, Dual, plural of Verbs),Purushah (First, second and third persons of Verbs and Subject),Subhashitam- Sathyam Maataa,,Samkrita Parichayah- Drishyam-Shravyam,Padyam-Gadyam- Champu,Story- Budhimaan shishyah,Chatu shlokah,Pushpaanaam Namani (Names of flowers) (2 hrs)

Sentences in Eka vachanam – with more examples,Kaala parichaya- Introduction of Tenses in Sanskrit,Chaatu sloka,Subhashitam,Kathaa,Vibhakti parichaya- Dwiteeyaa (2^{nd} case) (2 hrs)

Sentences in plural- with more examples,Mottos- 10 important institution's mottos in Sanskrit,Eg: Shradhavaan labhate jnaanam – Amrita,Vibhakti Parichaya – Triteeyaa (3^{rd} case),Bhasha Kreeda- Language game (2 hrs)

UNIT IV **6 Hours**

Sentence formation with Future tense and Past tense, Reciting – Verb forms in Present tense

Sloka from Bhagavad Gita,Vibhakthi Parichaya- Chaturthee (4^{th} case), Bhasha Kreedaa-Language game, Samskrita Paricahaya- Poets in Sanskrit,Kathaa-Story (2 hrs)

Situational Conversation,Shloka from Bhagavad Gita,Vibhakti Paricahya – Panchamee (5^{th} case),Kathaa- Story (2 hrs)

Sentence formation,Vibhakti Parichayah – (6^{th} case), Shloka from Bhagavad Gita,Kathaa-Story, Situational Conversation, Upasargah – Prefix (2 hrs)

UNIT V **6 Hours**

Introduction on Sandhi, Samasa and Pratyaya,Vibhakti Parichaya (7^{th} case), Introduction of Rama Sabda (24 forms with meaning),Reciting Rama Sabda,Reciting Verb in Present Tense (9 forms),Shloka from Bhagavad Gita,Situational Conversation (2 hrs)

Shloka from Bhagavad Gita,Reciting Rama Sabda,Reciting Verb in Present Tense (9 forms),Kartari- Karmani Introduction (2 hrs)

Situational Conversation activity of Students,Shloka chanting by Students,Rama sabda recitation,Verb Recitation,Sankhyaa,Samayah (2 hrs)

TEXT BOOKS :

1. Jessup W, Jessup E. Sanskrit is Fun (Part 1-3 bound together): A Sanskrit course book for beginners, 1st edn. Motilal Banarsidass Publishers Pvt. Ltd. 2012.
2. Shashtri SY. Sanskrit for Beginners, Sriyogi Publications Ahmedabad 2014.

REFERENCE BOOKS:

1. Sanskit through correspondence (English) – By Samskrita Bharathi Bangalore, 2018
2. Samskritam Thapaaliloode (Malayalam)- By Viswa Samskrita Prathishtanam, Kodungallur, 2016

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Hindi (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM02**

SCOPE: According to Article 343 of the Indian Constitution, Hindi in Devanagari script is the official language of the union. This course enables the students with effective speaking and listening skills in Hindi. It makes them realize the communication potential of the Hindi language. It trains them to use the Hindi language effectively to face interviews, group discussions, and public speaking. The course helps students to understand the different stages and relevance of Hindi literature.

This course opens pathways for careers in a variety of fields such as media, teaching, advertising and publishing, professional writing as well as studies in Hindi, Law, or Communication. Overall it stands at a higher position for development in any field where language is a predominant factor.

COURSE LEARNING OUTCOMES

Upon completion of the course students shall be able to;

KNOWLEDGE

K1: Define the fundamentals of language and its usage in different situations.
K2: Describe the structure of the language.
K3: Identify the roots of Hindi Literature and its perspective and methods.
K4: Explain the Philosophical methods of Hindi Literature.
K6 : Categorize the basis of the classification in Hindi Literature.
K7: Apply wide knowledge which allows them to be effective in their interpretations.

SKILL

S1: Develop verbal and non–verbal skills in communication
S2: Apply translation skills from Hindi to English and vice versa.
S3: Develop their writing and reading skills in Hindi
S4: Perform skillfully speaking and writing the grammatically correct language.
S5: Create intellectual ideas and makes them enrich their career
S6: Participate in group discussions to promote language skills.

ATTITUDE

A1: Appreciate the importance of Hindi in human life.
A2: Embrace an increased vision regarding literary value.
A3: Embrace the possibility of developing an interest in Hindi Literature.
A4: Recognize Hindi literary works based upon the traditional values of India and its cultures.
A5: Cultivate the knowledge of the environment and social responsibilities.

UNIT-1 **5 Hours**

Introduction to Hindi Language, other Indian Languages, Official Language, link Language Technical Terminology.(2hrs)
Hindi alphabet: Paribhasha Aur Bhed.
Shabda: Paribhasha Aur Bhed, Roopanthar ki Drishti se(1hr)
Sangya -Paribhasha Aur Bhed, Sangya ke Roopanthar-ling, vachan, karak (1hr)
Sarvanaam- Paribhasha Aur Bhed.(1hr)

UNIT –II **5 Hours**

Visheshan- Paribhasha Aur Bhed.
special usage of adverbs, changing voice and conjunctions in sentences. (2hrs)
Kriya- Paribhasha Aur Bhed, rupanthar ki drushti se-kaal(2hr)
Padhparichay(1hr)

UNIT –III **7 Hours**

Common errors and error corrections in Parts of Speech –with emphasis on the use of pronouns, Adjective, and verbs in different tenses –Gender& number (2hrs)
Conversations, Interviews, and Short speeches.(2hr)
Letter writing –Paribhasha Aur Bhed, Avedanpatra (request letter) &Practice(1hrs)
Translation-Paribhasa Aur Bhed, English to Hindi(2hrs)

UNIT -IV **6 Hours**

Film review (1hr)
Audio –Visual-Media in Hindi (1hr)
Movies appreciation and evaluation. (1hrs)
News reading and presentations on Radio and TV channels in Hindi (2hrs)
Samvaadhlekhan(1hr)

UNIT V **7 Hours**

Karmaveer (Poem) - Ayodhya Singh Upadhyay ‘Harioudh’ (1hr)
Manushyata (Poem) – Maithili Sharan Gupta (2hrs)
Mamata (Story) – Jayshankar Prasad (2hrs)
Kafan (Story) – Premchand(2hrs)

TEXT BOOKS :

1. Vyavaharik Hindi Vyakaran Anuvaad Tathaa Rachanaa- Dr. H. Parameswaran - Radhakrishna Publication, New Delhi, 2013.
2. Poetry :KavyaGanga-Ed: Chandrashekar –Suman Prakashan; Mysore, kavya Sargam-Ed; Dr.Santhosh Kumar Chaturvedi-Lokbharathi Prakashan
3. Hindi Patra Lekhan – Motilaal Chaturvedi -Vinod Pustak Mandir, Agra ,2009.

REFERENCE BOOKS :

1. Vyavaharik Hindi Vyakaran, Anuvadthaha Rachana: Dr. H. Parameswaran, Radhakrishna Publishing House, New Delhi,2013.
2. Vyakaran Manjari – Jayasingh Reddy – Pranavam Books, Calicut ,2003
3. Poetry :KavyaGanga-Ed: Chandrashekar –Suman Prakashan; Mysore, kavya Sargam-Ed; Dr.Santhosh Kumar Chaturvedi-LokbharathiPrakashan

**Latest edition of the textbooks & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Malayalam (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM03**

SCOPE: The course focuses generally on building basic language skills in Malayalam language as it is the principal language of communication the state. It covers the unique script and alphabet of language and on learning the alphabet and pronunciation. The course discusses the common words, phrases and expressions in Malayalam language. It empathises the importance of reading and formation of various parts of speech.

It also discusses Malayalam literature and culture which are the integral parts of studying the language. It focuses on translating texts from Malayalam to other languages and vice versa. It also deals with conversations in Malayalam to express their thoughts and to ask questions and respond to others. It also focuses on listening skills in various contexts and to express ideas. The course provides a solid foundation for further learning and development in the Malayalam language.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Outline the depth and necessity to learn the Malayalam
K2: Read the alphabets in Malayalam
K3: List few poems in Malayalam
K4: Explain sarvanamam and kriyas
K5: Discuss simple Malayalam poems
K6: Describe stories in Malayalam.

SKILL

S1: Write alphabets in Malayalam
S2: Translate English words and sentences to Malayalam
S3: Construct simple words and sentences in Malayalam
S4: Develop parts of speech and error free sentences
S5: Recite simple poems
S6: Speak in Malayalam

ATTITUDE

A1: Appreciate the richness of Malayalam language
A2: Cooperate in group discussions of speaking Malayalam
A3: Assist in activities to study Malayalam for effective communication
A4: Embrace moral values like kindness, selfless service etc.
A5: Create an awareness of gratitude as a social animal.
A6: Praise the language beyond its limits, the depth and expansion of conversation

COURSE CONTENTS:

UNIT I **(6 Hours)**

Malayalam Script (51 letters)
Vowels (Swarams) and consonants (Vyanjanams)-(1 hr)
Conjunct letters in Malayalam (1 hr)
Word formation in Malayalam(2 hrs)
Make sentences in Malayalam (2 hrs)

UNIT II **(4 Hours)**

Pronouns (Sarvanamams) (1 hr)
Genders (Ligams) (1 hr)
Number (Sanghyas) (1 hr)
Verb (Kriya) (1 hr)

UNIT III **(6 Hours)**

Basic sentences(2 hrs)
Paragraph writing. (2 hrs)
Translation of basic sentences. (2 hrs)

UNIT IV **(6 Hours)**

Reading Poems(2 hrs)
Telling Stories(2 hrs)
Acting small Skits etc. (2 hrs)

UNIT V **(8 Hours)**

Error-free Malayalam:
Language (2 hrs)
Clarity of expression (3 hrs)
Punctuation-Thettillatha Malayalam – Writing-a. Expansion of ideas (3 hrs)

Text books

1.Prof. Panmana Ramachandran Nair. Nalla basha, 5th edn. DC books. 2022

2. Panmana Ramachandran Nair. Thettillatha Malayalam 6th edn. DC. 1990 books

References

1. Panmana Ramachandran Nair. BHASHASUDHI - SAMSAYA PARIHARANGAL 2nd edn. Current books. 2013

2. Panmana Ramachandran Nair. THETTUM SARIYUM 2nd edn. Current books. 2015

3. C. V. Vasudeva Bhattathiri. Nalla Malayalam 3rd edn. Lipi Publications.1992

4. SREEKANTESWARAM G. PADMANABHA PILLAI. SABDHATHARAVALI.6th edn. DC books. 2020

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Psychology and Mental Health for Effective Living (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM04**

SCOPE: This course is designed to understand and apply the concepts of psychology and mental health to personal and professional life. It can be helpful to acquire the basic knowledge of behavior and effective living and to improve life skills. It can create an awareness of the factors that can deteriorate mental health and well-being.

The course intends to discuss the need and methods for stress coping and subjective well-being. It can be helpful to understand the concepts of learning, memory, attention, and perception. It also throws light on emotional intelligence and effective interpersonal communication. The course also focuses on the strategies to overcome health-compromising behaviors, along with the techniques and methods for handling the adversities of life. It can give an overview of the concepts of mental health, and common mental health conditions, along with the strategies of help and care for mental health issues, including mental health issues in the workplace. The course can be helpful to appreciate psychological management for healthy relationships and productive interactions.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the students shall be able to;

KNOWLEDGE

K1: Outline the concepts of psychology and fundamental processes underlying human behavior.
K2: Identify the factors that can deteriorate mental health and well-being.
K3: Recognize the warning signs of poor mental health.
K4: Discuss the need and methods for stress coping and subjective well-being.
K5: Explain the etiology, clinical manifestation, complications, diagnosis and management of mental disorders.
K6: Illustrate the strategies of help and care for mental health issues in workplace.

SKILL

S1: Demonstrate the concepts of learning, memory, attention and perception in day to day life.
S2: Analyze the aspects of emotional intelligence.
S3: Recommend the relevance and benefits of counseling.
S4: Develop effective interpersonal communication.
S5: Apply strategies to overcome health compromising behaviors.
S6: Propose the techniques and methods for handling the adversities of life.

ATTITUDE

A1: Accept the impact of psychology and mental health in the quality of life.
A2: Appreciate healthy relationships and empathetic interactions.
A3: Support people with mental health conditions.
A4: Follow the therapeutic approaches for the management of mental health conditions.
A5: Participate effectively in the process of communication by active listening.
A6: Assist people to overcome crisis situations.

COURSE CONTENTS

UNIT 1
Introduction to Psychology **4 Hours**
Definition, scope & major schools of psychology (1hr)
Learning & Memory (1hr)
Attention & Perception (1hr)
Parenting & Peer relationship (1hr)

UNIT II
Stress Coping and Subjective Well-being **3 Hours**
Nature and sources of stress, Types of stress – Pressure, Conflicts, and Frustration (1hr)
Stress and Health, Coping with Stress, Coping Strategies – Functional and Dysfunctional (1hr)
Well-being – Definition and determinants, Psychosocial impact and consequences of chronic illness and consequences (1hr)

UNIT III
Workplace mental health **3 Hours**
Mental health issues in workplace (1hr)
Strategies of help and care (1hr)
Health compromising behaviors (1hr)

UNIT IV
Emotional Intelligence **2 Hours**
Introduction & Components of emotional intelligence (1hr)
Emotional intelligence at workplace (1hr)

UNIT V
Mental Health and mental illness **2 Hours**
Overview of mental health - concepts, characteristics of mentally healthy person, Warning signs of poor mental health (1hr)
Psychosocial impact and consequences of mental illness diagnosis and consequences (1hr)

UNIT VI
Communication **2 Hours**
Process of communication, Listening (1hr)
Nonverbal Communication, Effective interpersonal communication (1hr)

UNIT VI

Anxiety **2 Hours**

Anxiety-introduction (1hr)

Anxiety-Management (1hr)

UNIT VII

Basics of Solution focused brief therapy **1 Hour**

UNIT VIII

Counseling **2 Hours**

Principles, Effective counseling, Types of counseling (1hr)

Characteristics of counselor, counseling terminally ill, Counseling the relatives, Counseling in rehabilitation practice (1hr)

UNIT IX

Addictions **2 Hours-**

Substance addiction (1 hr)

Other behavioral addiction (1 hr)

UNIT X

Introduction to Psychiatric illnesses **4 Hours**

Depression (1hr)

Schizophrenia (1hr)

Bipolar disorder (1hr)

Personality disorders (1hr)

UNIT XI **1 Hour**

Crisis situation

Suicide, Reaction to traumatic events (1hr)

UNIT XII

Psychological management (1hr) **1 Hour**

UNIT XIII

Psychopharmacology (1hr) **1 Hour**

Text Books

1. Robert A Baron, Girishwar Misra. Psychology, 5th edn, Pearson, 2000.

2. Shelley E. Taylor, Health Psychology, 10th edn, McGraw Hill, 2018.

3. Nyla R Baranscombe, Robert A Baron, Social Psychology, Pearson, 2017.

Reference Books

1. Saundra K. Ciccarelli, J. Noland White and Girishwar Misra, Psychology, 6th edn, Pearson, 2022.

2. Feldman, R. Understanding Psychology,10th edn, McGraw Hill, 2011.

3. David G. Myers, Jean M. Twenge. Social Psychology, 13th edn, McGraw Hill, 2021.

4. James N. Butcher, Jill M. Hooley, Susan M Mineka. Abnormal Psychology, 16th edn, Pearson, 2013.

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Gender Equality (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM05**

SCOPE: As a nation, we are moving forward to achieve Global Goals or Sustainable Development Goals (SDG) by 2030. Gender Equality is the fifth goal, which is built on the principle of "leaving no one behind". The civic responsibility of each and every citizen is to take part in the development process of our country. Gender inequality and gender discrimination become great hindrances in the nation-building process.

This course introduces the basic concepts related to gender, gender disparity, contemporary issues related to gender, and initiatives of the state to bring about gender equality. Increased awareness of gender will empower each one as a gender-sensitive individual. This course will help individuals to safeguard themselves from gender atrocities, at the same time will enable them to protect and consider every individual irrespective of their gender.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Define the Theoretical Perspectives on Gender
K2: Review the fluidity of gender as a concept
K3: Explain how the focus of sociology is shifting from macro to micro-lived experiences.
K4: Relate the basic concepts of gender and gender equality and explain gender disparities and issues related to gender inequality.
K5: Illustrate the state initiatives to reduce gender inequality**.**
K6: Explain the knowledge about patriarchy/matriarchy and its deep-rooted, invisible ramifications.

SKILL

S1: Explain identity politics featuring gender.
S2: Relate the concept of gender equality to sociology and make it more inclusive
S3: Apply the theoretical perspectives of gender to everyday experiences
S4: Construct a comparative understanding of gendered relations across the globe
S5: Compare the reflections on the Indian context of gender and its policy formulation
S6: Develop skills to unravel the undercurrents in the social movements revolving around gender across space and time.

ATTITUDE

A1: Accept the Consciousness about social reality characterized by marginalization and oppression

A2: Accept queer (LGBT) people and legal inclusion of Sexual Minorities

A3: Appreciate the responsibility to organize gender sensitization programs.

A4: Endorse a micro and subjective dimension in the discipline

A5: Radiate a feeling of empathetic understanding of oppression toward queer

A6: Participate in social movements questioning gender inequality.

UNIT I **4 Hours**

Gender:

Introduction:

Concepts: Sex and Gender, Gender Identity, Gender Equality, and Difference, Gender Roles (2hrs)

Gender Socialization, Gender Stereotyping, Gender Discrimination, Patriarchy, Feminism, Sexism

Gender Order**:** Masculinities, Femininities, LGBTQIA (2 hrs)

UNIT II **10 Hours**

Theories of Gender:

Liberal Feminism- Betty Friedan, Marxist feminism- Rosa Luxemburg (2hrs)

Radical Feminism- Shulamith Firestone (2hrs)

Psycho-analytical feminism- Nancy Chodorow, Julia Kristeva (1 hr)

Eco-feminism- Vandana Shiva (1hr)

Postmodern Feminism- Judith Butter (1hr)

Masculinities- Raewyn Connell (1hr)

Queer Theory (2hrs)

UNIT III **04 Hours**

Gender and Social Institutions:

Gender and Work (Production v/s Reproduction, Public v/s Private, Feminization of poverty (1 hr)

Gender in Marriage and Family (1hr)

Gender in Education (1hr)

Gender Disparity in Health Care (1hr)

UNIT IV **05 Hours**

Gender-specific crimes:

Female foeticide, Female infanticide, Domestic Violence (2hrs)

Sexual Harassment, Rape, Marital rape, Intimate partner violence, Trafficking, Prostitution (2hrs)

Gender portrayal in Media: Commoditization, Media violence (1 hr)

UNIT V **05 Hours**

International, National, and State Response to Gender Discrimination:

International Level: International Convention on Elimination of all forms of Discrimination against Women (CEDAW), MDG3 (2hrs)

National and State Level: National Human Rights Commission, Women's Commission, All Women's Police Stations, Vigilance Cell, Legal Aid− Cells, Women's Cell, Family Courts, Childline, Jagrata Samithi, Equal opportunity Cell, Service Providers, and Helplines for Women and Children, State Policy for Transgender in Kerala 2005 (3hrs)

UNIT VI **02 Hours**

Case Study, Video clip presentation (1 hr)

Gender sensitivity training(1hr)

TEXTBOOKS:

1. Ryle Robyn. Questioning Gender: A Sociological Exploration.5th edn, Sage Publications., London. 2023.

2. Megan T. Sexualities and Society: An Introduction. Sage Publications London.2023.

REFERENCE BOOKS:

1. Catherine V, Trautner S. The Kaleidoscope of Gender: Prisms, Patterns, and Possibilities.6th edn, Sage Publications., London .2019.
2. Kathleen F, Kandice G. Sociology of sexualities. Sage Publications., London.2020

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Health And Life Style (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM06**

SCOPE: The course aims at creating consciousness among the students towards health, fitnessand wellness. Students will be learning the exercises, yogasanas to keep them fit, they will learn about special diets for variusindications.

This can help in developing and maintaining a healthy life style by adapting good life style , good food habits, practicing yoga and excercise,right posture and realising the impact of alcoholism, smoking and understanding the diseases caused by wrong life style , habits and bad emotions and able to help the diseased with first aid.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, students shall be able to;

KNOWLEDGE

K1: Describe dimensions of health and concepts of wellness.
K2: Identify the major physical and psychological health concerns of our nation.
K3: Explain how personal decisions and behaviors affect health and impact the most common lifestyle diseases.
K4: Learn basic principles of nutrition and ways to obtain/maintain a healthy body composition.
K5: Describe and discuss the health related components of physical fitness and techniques for developing a personal exercise program.
K6: Identify healthy ways to cope with stress.and Describe the short and long term effects of alcohol, tobacco and other substances of abuse.

SKILL

S1: Practice the right life style habits
S2: Prepare therapeutic diets for diseases/disorders
S3: Demonstrateexcercises for muscle strength , cardiac endurance
S4: Apply the first aid techniques at times of need
S5: Demonstrate the right posture and resting pattern
S6: Determine your BMI, skin fold measurement and pulse rate

ATTITUDE

A1: Appreciate the best practices of your team and family members
A2: Contribute the importance of good habits to school and college students
A3: Realise the significance of home made food and fresh and raw food recipies

A4: Empathetic to patients and team members
A5: Take responsibility to prevent ill health
A6: Being a role model in adapting right life style, right food habits, right postures, practicing yogasanasto spread awareness

COURSE CONTENTS

UNIT I **5 Hours**

Concept of Physical Education and Health(1hr)
Definition, Aims and Objectives of Physical Education
Importance and Scope of Physical Education
Modern concept of Health, Physical fitness and Wellness, Health is wealth; Role of lifestyle habits on health(1hr)
Importance of adolescence; Stages, Characteristics and changes during adolescence(1hr)
Nutritional needs during adolescence why healthy lifestyle is important for adolescence(1hr)Eating Habits – eating disorders, skipping breakfast, junk food consumption.
Therapeutic Diets(1hr)

UNIT II **4 Hours**

Components of Physical Fitness
Physical fitness components - Speed, Strength, Endurance, Flexibility and Coordinative Abilities (1 hr)
Types of Physical Fitness (2 hr)
Health related Physical Fitness
Performance Related Physical Fitness
Cosmetic fitness
Fitness Balance (1 hr)

UNIT III **3 Hours**

Principles of Exercise Programme
Activities for developing Physical Fitness Components(1 hr)
Exercise and Heart rate Zones (1 hr)
Principles of First Aid (1 hr)

UNIT IV **4 Hours**

Nutrition Balance ,Fluid intake(1 hr)
Nutrition related problems; lifestyle related problems(1 hr)
Role of physical activity; resting pattern and postures(1 hr)
Personal habits – alcoholism, and other tobacco products, electronic addiction etc(1 hr)
Ethnic Foods

UNIT V

Yoga and Stress Management **6 Hours**
Asanas and its effects:-

Padmasana,Halasana,Bhujangasana(1 hr)
Shalabhasana,Dhanurasana,Shavasana(1 hr)
Vajrasana,Chakrasana,Trikonasana,Padahasthasana(1 hr)
Postural Deformities – Corrective measures (2 hrs)
Stress Management and Relaxation Techniques (1 hr)

UNIT VI **4 Hours**

Need for a Positive Life Style Change
Peer pressure &procrastination(1 hr)
Stress, depression(1 hr)
Suicidal tendency(1 hr)
Mini project review and viva, Whole portions revision.
Cooking without Fire or Wire (1 hr)
Healthy Snacks

UNIT VII **4 Hours**

Health related Physical Fitness and Assessment(1 hr)
Body mass Index/Skin fold Measurement, BMR, Pulse Rate, Blood Pressure-(2 hrs)
Health Related Physical Fitness Test. (1 hr)

TEXT BOOKS:

1. B. Srilakshmi, “Dietetics”, New age international (P) ltd, publishers, 2010.
2. “Nutrient requirement and Recommended Dietary Allowances for Indians”, published by Indian Council of Medical Research, ICMR, 2010.

ADDITIONAL READING MATERIELS

1. AAPHERD. “Health Related Physical Fitness Test Manual”. Published by Association drive Reston Virginia. 1980
2. ACSM Fitness Book, Leisure Press Campaign, Illions, , Leisure Press, Canada
3. http://www.pitt.edu./-gsphhome. 1996
4. ACSM”s “Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.
5. B.C.Rai Health Education and Hygiene Published by Prakashan Kendra, Lucknow
6. Bucher.C.A. Foundation of Physical Education 5th edn Missouri C.V.Mosby co. 1979
7. California: Mayfield Publishing Company
8. Corbin.CharlesBeetal. C.A., Concepts of Fitness and Welfare BostonMcGraw Hill. 2004
9. Frank V.M. Sports & education CA: ABC- CLIO. 2003
10. Les Snowdan., Maggie Humphrey’s Fitness walking, Maggie Humphery Orient
11. Paper Books New Delhi. 2002
12. Norman Bezzant Help! First Aid for everyday emergencies. Jaico Publishing House Bombay, Delhi

13. Principles of Physical Education: Com. Philadelphia: W.B.Sounders
14. Puri. K.Chandra.S.S. (2005). Health and Physical Education. New Delhi: Surjeet Publications

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Philosophy (T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM07**

SCOPE: This course offers a comprehensive introduction to the rich philosophical traditions of India and the West, specifically focusing on their practical applications in everyday life. In the Indian philosophy component, students will delve into the practical aspects of self-knowledge and the art of living. They will explore profound teachings from Vedānta, Bhagavad Gita, Buddha Philosophy, and Yoga Philosophy. Additionally, the course will examine the methodological approaches of Western philosophy through the study of influential figures such as Socrates, Plato, and Aristotle.

Throughout the course, students will cultivate critical thinking skills and develop a creative and problem-solving mindset by exploring diverse perspectives. These invaluable abilities will empower them to approach problems impartially and find effective solutions. Furthermore, students will be encouraged to exhibit appropriate behaviour, demonstrate independent thinking, offer constructive input, and actively engage in group discussions. This active participation will foster the development of positive character traits, resilience, and a strong moral foundation rooted in self-knowledge.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, students shall be able to;

KNOWLEDGE

K1: Discuss different schools of Indian philosophy
K2: Describe Western Philosophy
K3: Explain the concepts of right, wrong, good and bad
K4: Understand basic philosophical issues regarding the Self, Society and God.
K5: Able to differentiate the valid and invalid arguments.
K6: Summarize difficult ideas and concepts.

SKILL

S1: Develop critical thinking skills.
S2: Interpret philosophical texts
S3: Learn on your own
S4: Articulate views on philosophical topics
S5: Engage critically and constructively with moral problems and decisions
S6: Assess reality from different perspectives, with different people and in different ways

ATTITUDE

A1: Maintain classroom decorum.

A2: Keep your attention in class.

A3: Respect all cultures.

A4: Involve actively in class discussions.

A5: Show compassion for our fellow beings.

A6: Create a good argument.

COURSE CONTENTS

UNIT I: 10 Hours

Indian Philosophy-1

Introduction to Indian Philosophy (1hr)
Schools of Indian Philosophy (1hr)
Common Characters of the Indian System (1hr)
Vedānta Philosophy:Origin and Development of Vedānta (1hr)
Psychology of Upanishads (1hr)
Swami Vivekananda: Proofs for the existence of God, Universal Religion (3 hrs)
Nature of Self by Raman Maharshi (1 hr)
Self Inquiry by Raman Maharshi (1 hr)

UNIT II 9 Hours

Indian Philosophy-2

Practical Teachings of Bhagavad Gita (2 hrs)
Bhakti-Yoga, Jñana-Yoga and Karma-Yoga (1 hr)
Niṣkāma-Karma-Yoga (1 hr)
The Eightfold Means of Yoga (1 hr)
Introduction of Four Noble Truths (1 hr)
Cause of Suffering: The Chain of Twelve Links (1 hr)
The Problem of Freedom by J. Krishnamurti (1 hr)
The Ending of Fear by J. Krishnamurti (1 hr)

UNIT III

Western Philosophy-1 **4 Hours**

Chief Characteristics of Western Philosophy (1 hr)
Socrates, Plato and Aristotle:Introduction to Socrates and his method (1 hr)
Plato's Theory of Knowledge (1 hr)
Aristotle: Theory of Causation(1 hr)

UNIT IV 7 Hours

Western Philosophy-2
Rationalism and Descartes's Innate Idea (1 hr)
Method of Doubt (1 hr)
Lock's Refutation of Innate Idea (1 hr)
Introduction of Empiricism (1 hr)

Kant's Epistemology and His Transcendental Method (1 hr)
Reconciliation of Rationalism and Empiricism (1 hr)
Mill: The Method of Agreement and The Method of Difference (1 hr)

TEXT BOOKS:

1. Datta and Chatterjee, Introduction to Indian Philosophy, 8th edn.Calcutta University Press, Kolkata 2004.
2. M. Hiriyanna, Outlines of Indian Philosophy, 5th edn. Motilal Banarsidas Publishers, Delhi 2014.
3. Be as You Are: Teachings of Raman Maharshi, Edited by David Godman, Published by Arkana Penguin Books. (latest edition)
4. J. Krishnamurti. Think on These Things, Published by Krishnamurti Foundation India, Vasant Vihar, Chennai. (latest edition)
5. J. Krishnamurti. Freedom From Known, Published by Krishnamurti Foundation India, Vasant Vihar, Chennai. (latest edition)
6. Sharma C. Indian Philosophy: A Critical Survey, Barnes & Noble Publication London. (latest edition)

REFERENCE BOOKS:

1. Thilly F. A History of Philosophy, Henry Holt and Company, New York, U.S.A. (latest edition)
2. Y. Masih. A Critical History of Western Philosophy, Motilal Banarsidas Publishers, Delhi. (latest edition)
3. Copi and Cohen. Introduction to Logic, Published by Dorling Kindersley (India) Pvt. Ltd. Licensees of Pearson Education in South Asia. (latest edition)
4. Lal BK. Contemporary Indian Philosophy, Basant Kumar Lal, MLBD Publications, New Delhi. (latest edition)

**Latest edition of the text books & reference books can be referred.*

Course Title	L	T	P	Total Hrs.	Credits	Semester	Course Code
Economics(T)	**2**	**0**	**0**	**30**	**2**	**I-IV**	**BPHUM08**

SCOPE: The objective is to help the student to understand the basic economic parameters that interact with each other so that an economy may function effectively and efficiently. The focus is on making the various theoretical concepts clear and intelligible to a student. It provides the ability to recognize when change is appropriate, to adapt to change as it occurs, and to take the lead in creating change as the country's economic environment changes.

This also contributes to a better understanding of the demand and supply conditions and assesses the position of an organization. Overall, the scope of this subject encompasses the understanding of complex markets but comes away with strong analytical and problem-solving skills, as well as the business acumen necessary to succeed in the professional world.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student shall be able to;

KNOWLEDGE

K1: Explain the significance and fundamentals of economics.
K2: Describe the various concepts of economics that can be applied in the internal and external decisions to be made by business firms.
K3: Identify the demand and supply conditions and assess the position of a company.
K4: Apply the basic theories of economics in critical thinking and problem-solving.
K5: Conclude decisions based on demand and supply.
K6: Design competition strategies, including costing, pricing, product differentiation, and market environment according to the nature of products and the structures of the markets.

SKILL

S1: Develop the fundamental and technical concepts of economics.
S2: Demonstrate an awareness of their role in the global economic environment.
S3: Apply decisions wisely using cost-benefit analysis.
S4: Develop the ability to recognize and adapt to change, and take the lead in creating change.
S5: Analyze the links between production costs and the economic models of supply.
S6: Analyze how different degrees of competition in a market affect pricing and output.
S7: Apply economic reasoning to individual and firm behavior.

ATTITUDE

A1: Develop entrepreneurial skills in students.
A2: Foster a sense of urgency to make better decisions and formulate the right plans.
A3: Embrace skills needed to understand complex markets, as well as the business acumen necessary to succeed in the professional world.
A4: Construct ideas to succeed in an ever-changing world, which includes businesses, market flow, opportunities, and threats.
A5: Develop knowledge to evaluate alternatives and make better choices.
A6: Appreciate the impact of economics on long-term success and lifetime earnings

COURSE CONTENTS

UNIT I **7 Hours**

Introduction to Economics:

The problems of wants, scarcity, and choice - Difference between microeconomics and macroeconomics.(2 hrs)
Importance and limitations of Microeconomics and Macroeconomics.(1hr)
Basic problems of Economics: What to Produce, How to Produce, For Whom to Produce, Level of Resource Use, and Flexibility.(2 hrs)
Economic systems –Capitalism–Command Economy–Mixed Economy.(2 hrs)

UNIT II **7 Hours**

Demand and Supply Analysis:

Concept of demand-Demand schedule and demand curve–Law of demand -factors influencing demand. (3 hrs)
The elasticity of demand. Supply: Concept, Supply schedule, and supply curve–Law of supply-Factors influencing supply.(4 hrs)

UNIT III **6 Hours**

Production, Cost and Revenue Analysis: Meaning of production:
Production function – The Law of Variable Proportions or the Law of Diminishing Marginal Returns – Returns to scale – Cost and production: Various concepts of cost-Revenue function: Total, Average and Marginal revenue–Profit maximization: TR-TC and MR-MC approaches. (5 hrs)
Economies of scale.(1 hr)

UNIT IV **5 Hours**

Theory of Markets

Meaning and types of markets–Main features of Competitive, Monopoly, Monopolistic, and Oligopoly markets.(3 hrs)

Price discrimination: Meaning and Types.(2 hrs)

UNIT V **5 Hours**

Macroeconomics:

National income analysis: Meaning, Concepts, and Concept of full employment–Types of unemployment.(3 hrs)

Inflation: Meaning, Types, and Control of Inflation: Monetary and Fiscal Policies. (2 hrs)

TEXTBOOKS:

1. Varshney & Maheswari; Managerial Economics, Sultan Chand & Sons., 2009.
2. Mehta,P.L; Managerial Economics, Sultan Chand & Sons.,2003.
3. Dwivedi, D.N; Managerial Economics, VikasPublishingHouse.,2003.

REFERENCE BOOKS:

1. Mehta,P.L;ManagerialEconomics,SultanChand&Sons.,2003.
2. Koutsoyiannis,A.;ModernMicroEconomics,MacmillanPressLtd.,2003.
3. Salvator, Dominick.; Managerial Economics, McGraw-Hill Book Company., 2009.

**Latest edition of the text books & reference books can be referred.*