K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF MEDICAL AND ALLIED SCIENCES

(SMAS)

Programme Handbook

(Programme Structure & Evaluation Scheme)

Bachelor of Pharmacy

Programme Code: 12

FOUR YEAR UNDERGRADUATE PROGRAMME

(2024-2025)

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K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

S.No	Description	Page Number
1.	Preface	1
2.	University vision & mission	2
3.	About School	3
4.	School vision & mission	3
5.	Program (Introduction)	4
6.	Definitions: Programme Educational Objectives (PEOs), Programme Outcomes (POs), Programme Specific Outcomes (PSOs)	4
7.	Programme Educational Objectives (PEOs	5
8.	Programme Outcomes (POs),	5
9.	Programme Specific Outcomes (PSOs)	6
10	Student's Structured Learning Experience from Entry to Exit in the Programme	8-9
11	Educational Planning and Execution: What, when and how learning will happen	10-16
12	Bachelor of Pharmacy (Schemes for internal assessments and end semester examinations semester wise)	17-29
13	Detailed syllabus	30-335

1. Preface

The K.R. Mangalam Group has made a name for itself in the field of education. Over a period, the various educational entities of the group have converged into a fully functional corporate academy. Resources at KRMU have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly inter-disciplinary environment wherein they develop integrative skills through interaction with students from engineering, management, journalism and media study streams.

The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education. With the mushrooming of institutions of Higher Education in the National Capital Region, the university considered it very important that students take informed decisions and pursue career objectives in an institution, where the concept of education has evolved as a natural process.

K.R. Mangalam University was founded in the year 2013 by Mangalam Edu Gate, a company incorporated under Section 25 of the Companies Act, 1956.

Uniqueness of KRMU

i. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
ii. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Education Objectives

i. To impart undergraduate, post-graduate and Doctoral education in identified areas of higher education.
ii. To undertake research programmes with industrial interface.
iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.
iv. To act as a nodal center for transfer of technology to the industry.
v. To provide job oriented professional education to the student community with particular focus on Haryana.

2. University Vision and Mission

2.1 Vision

K.R. Mangalam University aspires to become an internationally recognized institution of higher learning through excellence in inter-disciplinary education, research, and innovation, preparing socially responsible life-long learners contributing to nation building.

2.2 Mission

- Foster employability and entrepreneurship through futuristic curriculum and progressive pedagogy with cutting-edge technology
- Instill the notion of lifelong learning through stimulating research, Outcomes-based education, and innovative thinking
- Integrate global needs and expectations through collaborative programmes with premier universities, research centres, industries, and professional bodies.
- Enhance leadership qualities among the youth understanding ethical values and environmental realities

3. About School of Medical and Allied Sciences

School of Medical and Allied Sciences mainly focused on training to students for various subjects and practical aspects related to drug formulation and testing along with co-curricular development. School offers Diploma, undergraduate, post graduate courses in pharmacy. We provide an extra edge to our students by teaching and training by leading Pharma industry experts to facilitate industry academia interaction, participation in conferences / workshops / skill development programs, carrier guidance, coaching for GPAT and other competitive examinations. We encourage students to participate in various health camps organized by department to make general awareness amongst people regarding various diseases like diabetes, hypertension, communicable and non-communicable diseases. We provide placement assistance to students for getting jobs in various government and private laboratories. We have tie up with various pharmaceutical industries like Dabur Research Foundation, Sun Pharma, Arbo Pharma, Indian Pharmacopeial Commission, Catalyst Clinical Services, Suraksha Pharma, Medicamen Biotech , Mankind Pharma etc. which provide various carrier opportunities in pharmaceutical production, pharmaceutical quality control, quality assurance, pharmaceutical sales & distribution, drug information services, health insurance, medical coding, supply chain management, forensic sciences, pharmacovigilance, product management team, clinical trials, clinical data management and in Indian Pharmacopeia Commission

4. School Vision and Mission

4.1 Vision:

To become a premier educational institution dedicated to empowering students with the knowledge and skills needed to lead in pharmaceutical field and enhance healthcare access, thereby making a positive impact on society in India and globally.

4.2 School Mission

- To empower students to become self-motivated, self-reliant, and socially aware healthcare professionals, effectively addressing the needs of academia, industry, and research.
- To establish a dynamic centre of excellence for learning and research in pharmaceutical and allied health sciences, emphasizing interdisciplinary approaches and fostering collaboration between industry and academia.
- To nurture translational research initiatives that benefit society and improve community health outcomes.

- To integrate pharmaceutical and allied health sciences with interdisciplinary life sciences, promoting innovation and collaboration.
- To offer lifelong learning opportunities in healthcare, equipping professionals with the skills to adapt and excel in a rapidly evolving field.

5. About the Programme: Bachelor of Pharmacy

School offers Bachelor of Pharmacy programs is designed to impart scientific knowledge to the students and will provide theoretical as well as practical training in their respective fields. The program offered by the school is approved by Pharmacy Council of India, New Delhi. The curriculum has been specifically designed to impart latest knowledge and skills relevant to Pharmaceutical Sciences including Industrial Visits / Training / Guest Lectures of Experts from Industry and Academia

5.1 Bachelor of Pharmacy Programme

The course of study for Bachelor of Pharmacy shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curriculum and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi

It strives to cultivate a deep understanding of pharmaceutical sciences, regulatory compliance, and medical ethics, while also encouraging critical thinking, creativity, and adaptability. Through a combination of classroom instruction, practical projects, internships, and exposure to cutting-edge technologies, this programme aims to produce healthcare professionals who are not only well-informed but also socially responsible and technical savvy.

6.Definitions

- **Programme Educational Objectives (PEOs)**

  Programme Educational Objectives of a degree are the statements that describe the expected achievements of graduates in their career, and what the graduates are expected to perform, achieve and how they will conduct professionally during the first few years after graduation.

- **Programme Outcomes (POs)**

  Programme Outcomes are statements that describe what the students are expected to know and would be able to do upon the graduation. These relate to the skills, knowledge, and behaviour that students acquire through the programme.

- **Programme Specific Outcomes (PSOs)**

  Programme Specific Outcomes are statements about the various levels of knowledge specific to the given program which the student would be acquiring during the program.

- **Credit**

  Credit refers to a unit of contact hours/tutorial hours per week or 02 hours of lab/practical work per week

6. 1Programme Educational Objectives (PEO*)*

These are deferred outcomes measured few years after completion of the programme, where the graduates of this program will:

1. Become professionals and service provider in careers related to healthcare, paramedical, and related fields, demonstrating expertise and adaptability.
2. Emerge as leaders, entrepreneurs, and researcher, managerial health professionals and trainer in the field of medical and allied sciences.
3. Uphold ethical standards in their professional conduct, making responsible decisions that contribute to the integrity of the healthcare domain.
4. Promoter for and engage in environment-friendly and sustainable practices, promoting responsible medical and allied sciences.
5. Serve as good citizens and valuable members of society, demonstrating high human and professional values while contributing to societal well-being.

6.2 Programme Outcomes (PO)

At the end of the programme the students will be:

1. Demonstrate a comprehensive understanding of foundational concepts and principles in pharmaceutical and allied sciences, enabling the application of knowledge to real-world challenges.
2. Analyzing, and effectively communicating the significance of their professional roles within society in every stage of healthcare system.
3. Solve complex problems related to the on-ground and daily challenges of the healthcare sciences and exhibit strong critical thinking and reasoning abilities.

4. Showcase strong interpersonal skills that enable effective teamwork, collaboration, and networking in multidisciplinary environments.
5. Exhibit an understanding of environmental concerns and integrate sustainable practices.
6. Learn high ethical standards and professionalism in decision-making, reflecting a commitment to truth, fairness, and responsibility.
7. Demonstrate entrepreneurial abilities like thinking, creativity, and leadership by taking initiative, managing projects, and addressing challenges.
8. Ability to generate required information for decision-making through use of scientific methods.
9. Utilize best scientific evidence in organizational theory, human resource management, health care policy, and information technology to improve healthcare quality and patient safety.
10. Honoring personal values and applying ethical principles in professional and social contexts and taking responsibility for the outcomes associated with the decisions

6.3 Programme Specific Outcomes (PSO)

At the end of the program the students will be:

1. Understanding theories, models, frameworks, tools, and techniques related to various fields of pharmaceutical sciences viz., Pharmaceutics, Pharmaceutical Chemistry, Pharmacology, Pharmacognosy, Biotechnology, Pharmaceutical jurisprudence and pharmaceutical marketing etc. in real world
2. Applying the fundamental principles of pharmaceutical sciences to the formulation-development, and evaluation of pharmaceuticals, ensuring effective therapeutic outcomes and patient safety.
3. Analysing drug assay methods, manufacturing process, different packaging, drug interactions, mechanisms of action, and therapeutic strategies to address complex health issues and research communication trends to assess their impact on society, culture, and health economics.
4. Evaluating ethical standards, pharmaceutical legal considerations, clinical data, patient outcomes to guide evidence-based therapies, while adhering to ethical principles and professional standards in delivering pharmaceutical care and public health services.

5. Creating innovative, high-quality health promoting content, such as articles on drug abuse, adverse reports, videos, or social media campaigns, utilizing technical skills and creative storytelling.

a. **Career Avenues**

A Bachelor of Pharmacy opens up a wide range of career avenues like the following but not limited to:

a) Drug Inspector: A Drug Inspector ensures that the production, distribution, and sale of medicines comply with established quality standards and regulations.

b) Drug Analyst: Drug Analysts are responsible for conducting chemical, biological, and microbiological tests on drugs to ensure their quality and potency.

c) Research & Development: Professionals in R&D focus on the discovery, design, and development of new drugs, cosmetics, diagnostic tools, and vaccines. R&D is an intellectually challenging and rewarding field with opportunities in both public and private sectors.

d) Patents Officer: Drug Patent specialists deal with the legal aspects of drug development. They are responsible for filing patents, ensuring intellectual property rights, and protecting innovations from competitors.

e) Medical Writing: Medical Writers are responsible for producing well-structured scientific documents related to drugs, clinical trials, and healthcare. Pharmaceutical companies, contract research organizations, and healthcare publications offer opportunities for medical writers.

f) Quality Control: Quality Control professionals ensure that products meet the required quality and safety standards. They are involved in testing raw materials, in-process products, and finished products in pharmaceutical manufacturing.

g) Clinical Research: Clinical Researchers design and conduct trials to evaluate the safety and efficacy of drugs and medical devices

h) Hospital Pharmacy: Hospital Pharmacists are healthcare professionals responsible for the safe dispensing of medications to patients in hospitals.

i) Pharmaceutical Industries: The pharmaceutical industry is vast and offers careers in various sectors, including production, regulatory affairs, formulation development, and packaging. Professionals can work in a range of functions from research to marketing and sales.

j) Regulatory Affairs: Regulatory Education professionals focus on teaching and training in the field of drug regulations and compliance. They work in academic institutions, government agencies, or industry training departments, helping future professionals understand legal, ethical, and safety standards governing the pharmaceutical industry.

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b. **Duration –**

The course of study for B. Pharmacy shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curriculum and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

c. **Criteria for award of certificates and degree**

The minimum credit points required for award of a Bachelor of Pharmacy degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. Learners are expected to follow the semester-wise schedule of courses given in the syllabus. The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

7.Student's Structured Learning Experience from Entry to Exit in the Programme

- **Education Philosophy and Purpose**:

- **Learn to Earn a Living:**

  At KRMU we believe in equipping students with the skills, knowledge, and qualifications necessary to succeed in the job market and achieve financial stability. All the programmes are tailored to meet industry demands, preparing students to enter specific careers and contributing to economic development.

- **Learn to Live:**

  The university believes in the holistic development of learners, fostering sensitivity towards society, and promoting a social and emotional understanding of the world. Our aim is to nurture well-rounded individuals who can contribute meaningfully to society, lead fulfilling lives, and engage with the complexities of the human experience.

- University Education Objective: **Focus on Employability and Entrepreneurship through Holistic Education using Bloom's Taxonomy**

By targeting all levels of Bloom's Taxonomy—remembering, understanding, applying, analysing, evaluating, and creating—students are equipped with the knowledge, skills, and attitudes necessary for the workforce and entrepreneurial success. At KRMU we emphasize on learners critical thinking, problem-solving, and innovation, ensuring application of theoretical knowledge in practical settings. This approach nurtures adaptability, creativity, and ethical decision-making, enabling graduates to excel in diverse professional environments and to innovate in entrepreneurial endeavours, contributing to economic growth and societal well-being.

- **Importance of Structured Learning Experiences**

A structured learning experience (SLE) is crucial for effective education as it provides a clear and organized framework for acquiring knowledge and skills. By following a well-defined curriculum, teaching-learning methods and assessment strategies, learners can build on prior knowledge systematically, ensuring that foundational concepts are understood before moving on to more complex topics. This approach not only enhances comprehension but also fosters critical thinking by allowing learners to connect ideas and apply them in various contexts. Moreover, a structured learning experience helps in setting clear goals and benchmarks, enabling both educators and students to track progress and make necessary adjustments. Ultimately, it creates a conducive environment for sustained intellectual growth, encouraging learners to achieve their full potential. At K.R. Mangalam University SLE is designed as rigorous activities that are integrated into the curriculum and provide students with opportunities for learning in two parts:

Inside Classroom

A structured approach within the classroom focuses on the following key aspects:

- **Cognitive Outcomes**: Classroom learning aims to enhance critical thinking, problem-solving, and decision-making skills. These outcomes help students develop a deep understanding of pharmaceutical practices, and healthcare challenges.
- **Student-Centric Learning**: The learning process is designed to actively involve students, fostering an environment of inquiry and engagement. This may include discussions, case studies, group projects, and interactive sessions to personalize the learning experience.
- **Methods and Approaches**: Diverse teaching methods are employed to enhance cognitive development. These include:

    - ✓ **Lectures**: For foundational understanding.
    - ✓ **Group Discussions**: To facilitate peer learning.
    - ✓ **Case Studies**: To promote application of theory in real-life scenarios.

- ✓ **Problem-Based Learning (PBL)**: Focuses on active problem-solving and research.

- **Tools and Techniques**: Technology and modern educational tools enhance classroom experiences. Examples include:

  - ✓ **E-learning platforms and simulations** for understanding complex drug mechanisms.
  - ✓ **Interactive software for clinical calculations and drug design models**.
  - ✓ **Laboratory-based tools** to reinforce practical understanding.

Outside Classroom

Experiences outside the classroom are designed to develop both psychomotor and people skills. These practical experiences help students integrate knowledge with hands-on practice:

- **Industry Internships and Industrial Visits**: Exposure to real-world pharmaceutical industry practices, including drug manufacturing, quality assurance, and research and development, helps students apply their classroom knowledge to industrial settings.
- **Community Pharmacy Training**: Involves students in working with community pharmacies, where they develop communication skills, understand patient needs, and enhance their knowledge of drug dispensing and patient education.
- **Laboratory Practicals**: Hands-on lab work in pharmaceutics, pharmacology, and pharmaceutical chemistry labs help in refining the psychomotor skills necessary for professional practice.
- **Collaborative Research Projects**: Involves students in ongoing research, fostering innovation and scientific inquiry while cultivating teamwork and project management skills.
- **Fieldwork and Health Camps**: Encourages students to work with healthcare professionals in various settings, building their ability to engage with communities and deliver patient-centric care.

➢ **Educational Planning and Execution: What, when and how learning will happen**

The Bachelor of Pharmacy programme is designed around the educational philosophy of "Learn to Earn Living" and "Learn to Live," providing a holistic learning experience from entry to exit. A well-defined academic plan is essential for ensuring structured and timely delivery of the B Pharmacy curriculum. The following components contribute to the successful implementation and continuous enhancement of the learning experience:

Calendar

The academic calendar outlines key dates for lectures, exams, internships, and assessments, ensuring a well-structured progression of the curriculum. It balances theoretical and practical sessions with co-curricular activities, enabling timely completion and comprehensive learning.

Faculty

Experienced faculty ensure high-quality education by designing up-to-date course content, employing student-centric teaching methods, and providing mentorship. Continuous faculty development programs ensure they remain updated with modern practices in pharmacy education.

Monitoring & Review

Student progress is monitored through continuous assessment and feedback. Regular review meetings allow faculty to evaluate course delivery, address challenges, and refine teaching strategies. Student feedback plays a critical role in improving academic quality.

Correction & Continuous Improvement

The program follows a cycle of ongoing improvement, using feedback and performance reviews to update curricula, refine teaching methods, and enhance faculty development. This ensures the program remains current and responsive to industry needs.

Entry Phase

Upon entry, students are introduced to the foundational principles of pharmaceutical sciences. Orientation sessions focus on understanding the pharmacy landscape and the ethical responsibilities of communicators. This initial phase emphasizes the importance of knowledge not just to earn a living, but as a way to engage meaningfully with society.

Core Learning

As students advance, they dive deeper into both theoretical and practical aspects of the field. Courses on pharmaceuticals equip students with critical skills necessary for their future careers. Practical workshops and industry collaborations reinforce the idea of learning as a preparation for earning, while also nurturing a sense of civic responsibility and personal growth. We have a strong students' support system in terms of differential learning (slow & fast learning), mentor-mentee system and personal counselling thereby ensuring students move up on the learning curve.

Skill Development

The programme places a strong emphasis on developing versatile skills—research, writing, laboratory Practical, Industry Internships, Clinical and Community Training and soft skill for a successful career in healthcare. Through collaborative projects, visit to industry, industry connect, and networking students learn teamwork and communication, vital not just for professional success but also for fostering meaningful relationships in their personal lives.

Capstone and Exit Phase

In the final phase, students undertake capstone projects that integrate their learning and showcase their creativity and professionalism. This culminates in a portfolio that reflects their readiness to enter the workforce. Additionally, career services assist in job placements, reinforcing the "Learn to Earn Living" philosophy. However, the emphasis on personal values and lifelong learning remains a cornerstone, encouraging students to approach their careers to contribute positively to society.

Co-Curricular and Extra-Curricular Activities

Students actively participate in 13 clubs and societies within the university, ranging from health societies to cultural expression. These clubs facilitate peer interaction, teamwork, and leadership opportunities, helping students develop a well-rounded personality. Regular industry visits, guest lectures, and workshops by industry experts ensure that students remain connected to real-world healthcare practices, bridging the gap between academic learning and professional expectations.

Community Connect

Community connects programmes enhance students' social awareness and responsibility, allowing them to engage with various societal issues. Participation in sports and cultural activities further contributes to a balanced lifestyle, promoting teamwork and resilience.

Ethics and Values

The programme places a strong emphasis on ethics, values, and a code of conduct. Students are encouraged to embody professionalism and integrity in their work, preparing them to be responsible communicators and active citizens.

Career Counselling and Entrepreneurship

Career counselling services provide guidance on job placements, internships, and skill development, helping students navigate their career paths. Additionally, the university's

incubation centre fosters entrepreneurial and leadership qualities, encouraging students to explore innovative ideas and start their ventures.

Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of Bachelor of pharmacy. program if he/she secures at least 50% marks in that course including internal assessment. For example, to be declared as PASS and to get grade, the student must secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However, his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

Re-examination of end semester examinations

Re-examination of end semester examination shall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time to time.

- **Co-curricular / Extracurricular activities/Community Service:**

Participation in Co/ Extracurricular activities is part of outside classroom learning.

Students must earn 2 credits from co/ extracurricular activities. One credit from participation in co curricular activities like Club/Society activities and another credit from Community Service (1 credit each) through participation in NSS/ Redcross activities or NGOs that contribute to their personal development, leadership skills, and community engagement.

- Under the category of **Club/Society**, 1 credit can be earned by registration in one of the Club/Societies of university and active participation in the events organized by the club/society **OR**
- 15 hours of active engagement in any of the recreational/sports activities

Under the category of **Community Service**, 1 credit can be earned by

- 15 hours active engagement in community service through NGO/NSS/Redcross or any other society approved/ empanelled by the university

At the end of the semester, students are required to submit a log of hours, a report, and a certificate of participation/ completion summarizing their activities followed by a presentation.

Academic Support Services (Differential learning needs): Academic Support Services for Bachelor of Pharmacy students are designed to cater to diverse learning needs, ensuring that every student fairs well. These services include:

- **Individualized Instruction**: Tailoring lessons to the student's pace and learning style can help. This may include breaking down complex tasks into smaller, manageable parts and providing more frequent check-ins.
    - Workshops and Seminars: Regular workshops on topics like current research, regulations, challenges, other experiential learning activities and industrial connect help students enhance their practical skills and theoretical understanding.
    - Peer Mentoring Programs: Advance learner students mentor the students by becoming team leaders, providing guidance on course components, assignments and projects, fostering a supportive system.
    - Accessible Learning Resources: Online platforms offer access to a range of resources, including video lectures, articles, and interactive tools, accommodating different learning styles.
    - Production and Outcome based activities: Students are encouraged to get more involved in practical and hands-on based activities to come up with productivity which is showcased and appreciated. This way it gives a boost to the students.
    - Diversity and Inclusion Initiatives: Programs aimed at promoting inclusivity ensure that all voices are heard and valued, enriching the learning environment.
    - Feedback and Assessment: Continuous feedback mechanisms allow students to receive constructive review of their work, facilitating growth and improvement.

- **Student Support Services**
  - **Mentor-Mentee:** The Mentor-Mentee Program is an essential component for fostering successful careers as it acts as a bridge between faculty and students. Mentor-mentee relationships often go beyond academic and professional growth at KRMU.
  - **Counselling and Wellness Services:** Counselling and Wellness Services for Pharmacy students are designed to support their mental health and overall well-being in a demanding academic environment. These services include confidential individual counselling sessions, where trained professionals provide guidance on stress management, time management and personal challenges. Group therapy sessions and workshops focus on topics such as resilience, coping strategies and mindfulness, promoting a sense of community and shared experiences. The school conducts sessions on mental health awareness from time to time. Wellness initiatives may include fitness programs, relaxation activities and access to health resources that promote physical and mental health. By creating a supportive environment, these services help students navigate the pressures of their studies while fostering a balanced and healthy lifestyle.
  - **Career Services and Training:** The Career Development Center (CDC) at KRMU provides comprehensive career services and training for pharmacy students, focusing on creating ample placement opportunities. In addition to inviting corporate recruiters to campus, the Centre hosts various counselling and training programs aimed at enhancing students' academic and professional skills. These programs equip students with the essential tools needed to secure lucrative careers in their field. Each year, prominent companies visit the KRMU campus, offering attractive job packages to emerging talent. The faculty members and the mentors also ensuring that students are well-prepared for the competitive job market.
- **Assessment and Evaluation**
  - Grading Policies and Procedures for theory courses, practical courses, projects, Internships, Dissertation: As per university examination policy of K R Mangalam University, the Program Outcome assessments is done by aggregating both direct and indirect assessments, typically assigning 80% weightage to direct assessments and 20% to indirect assessments, to compute the final course attainment.

- **Feedback and Continuous Improvement Mechanisms:** Teaching-learning is driven by outcomes. Assessment strategies and andragogy are aligned to course outcomes. Every CO is assessed using multiple components. The attainment of COs is calculated for every course to know the gaps between the desired and actual outcomes. These gaps are analysed to understand where does the student lags in terms of learning levels. Thereafter each student's learning levels are ascertained, if found below desirable level, and intervention strategy is affected in the following semester to make necessary corrections. To cater to the diverse learning needs of its student body, K.R. Mangalam University employs a comprehensive assessment framework to identify both slow and advanced learners. Students' learning levels are continually assessed based on their performance at various stages. If a student's performance in internal assessments falls below or equal to 55%, they are categorized as slow learners. Conversely, if a student's performance score in internal assessments is greater than or equal to 80%, they are identified as advanced learners. Such students are encouraged to participate in advanced learning activities. Through periodic evaluations and the utilization of modern management systems, the institution adeptly tracks students' performance across various courses, allowing for targeted interventions and support mechanisms.
- **Academic Integrity and Ethics:** The School of Medical and Allied Sciences places a strong emphasis on academic integrity and ethics, fostering a culture of honesty and responsibility among students. Clear guidelines are established to educate students about the importance of plagiarism prevention, proper citation practices, and ethical sourcing in their work. Regular workshops and seminars are conducted to discuss case studies and real-world scenarios, encouraging critical thinking about ethical dilemmas in healthcare system. Faculty members serve as role models, promoting transparency and accountability in their interactions and evaluations. By instilling these values, the school prepares students to uphold high ethical standards in their professional careers, emphasizing the critical role that integrity plays healthcare system

Detailed Syllabus

Bachelor of Pharmacy

Table-1: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy andPhysiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RB	Remedial Biology/	5	10	1 Hr	15	35	1.5 Hrs	50

T BP106R MT	Mathematics – Theory*							
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112R BP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
	Total	**70/75[$]/80[#]**	**115/125[$]/130[#]**	**23/24[$]/26[#] Hrs**	**185/200[$]/210[#]**	**490/525[$]/540[#]**	**31.5/33[$]/35[#] Hrs**	**675/725[$]/750[#]**

[#]Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

[$]Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

Non University Examination (NUE)

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**80**	**125**	**20 Hrs**	**205**	**520**	**30 Hrs**	**725**

***** The subject experts at college level shall conduct examinations

Semester III

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	PhysicalPharmaceuticsI –Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**

Semester V

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				

BP501T	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Industrial PharmacyI– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Industrial PharmacyI– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**65**	**105**	**17 Hr**	**170**	**480**	**27 Hrs**	**650**

Semester VI

Course code	**Name of the course**	**Internal Assessment**				**End Semester Exams**		**Total Marks**
		Continuous Mode	**Sessional Exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100

BP605T	Pharmaceutical Biotechnology– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**75**	**120**	**18 Hrs**	**195**	**555**	**30 Hrs**	**750**

Semester VII

Course code	**Name of the course**	**Internal Assessment**				**End Semester Exams**		**Total Marks**
		Continuous Mode	**Sessional Exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100

BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
Total		**70**	**70**	**8Hrs**	**140**	**460**	**21 Hrs**	**600**

***** The subject experts at college level shall conduct examinations

Semester VIII

Course code	**Name of the course**	**Internal Assessment**				**End Semester Exams**		**Total Marks**
		Continuous Mode	**Sessional Exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory							
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory	10 + 10	15 + 15 =	1 + 1 =	25 + 25 =	75 + 75	3 + 3 = 6	100 +

BP807ET	Computer Aided Drug Design – Theory	= 20	30	2 Hrs	50	= 150	Hrs	100 = 200
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812PW	Project Work	-	-	-	-	150	4 Hrs	150
Total		**40**	**60**	**4 Hrs**	**100**	**450**	**16 Hrs**	**550**

Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall beawarded as per the scheme given below.

Table-XXXX: Scheme for awarding internal assessment: Continuous mode

Theory		
Criteria	**Maximum Marks**	
Attendance (Refer Table – XII)	4	2
Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3	1.5
Student – Teacher interaction	3	1.5

Total	**10**	**5**
Practical		
Attendance (Refer Table – XII)	2	
Based on Practical Records, Regular viva voce, etc.	3	
Total	**5**	

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

Percentage of Attendance	Theory	Practical
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical Sessional examinations is given below. The average marks of two Sessional exams shall be computed for internal assessment as per the requirements given in tables – X.

The sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. Similarly Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks.

Question paper pattern for theory Sessional examinations

I. Multiple Choice Questions (MCQs) OR		=	10 x 1 = 10 OR
Objective Type Questions (5 x 2)		=	05 x 2 = 10
(Answer all the questions)			
I. Long Answers (Answer 1 out of 2)		=	1 x 10 = 10
II. Short Answers (Answer 2 out of 3)		=	2 x 5 = 10
	Total	=	30 marks

For subjects having Non-University Examination			
I. Long Answers (Answer 1 out of 2)		=	1 x 10 = 10
II. Short Answers (Answer 4 out of 6)		=	4 x 5 = 20
	Total	=	30 marks

Question paper pattern for practical sessional examinations I. Synopsis		=	10
II. Experiments		=	25
III. Viva voce		=	05

Total	=	40 marks

Promotion and award of grades

A student shall be declared PASS and eligible to get a grade in a course of B. Pharm program if he/she secures at least 50% marks in that particular course including internal assessment. For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Class Handouts for each course

SEMESTER I					
BP101T	**Human Anatomy and Physiology-I (Theory)**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**		**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pathophysiology				

Course Perspective

In this course, students will gain a comprehensive understanding of the human body, exploring its structure and functions at various levels, from cells to systems. They will learn about the interconnections between different bodily systems and how they work together to maintain homeostasis. Additionally, students will explore the intricacies of the cardiovascular, nervous, and lymphatic systems, as well as the importance of blood and body fluids in overall health. Practical insights into the functioning of sensory organs and muscle physiology will enhance their appreciation of the body's complexity and resilience.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the structure and functions of the human body, including anatomy, physiology, and levels of organization.

CO2: Applying knowledge to identify and different body systems, tissues, and cellular processes involved in human physiology.

CO3: Analysing the components and functions of body fluids, blood, and the lymphatic system, including coagulation mechanisms and disorders.

CO4: Evaluating the cardiovascular and peripheral nervous systems, including their anatomy, functions, and associated disorders

Course Content

UNIT I **10 hours**

- **Introduction to human body**

  Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.
- **Cellular level of organization**

Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling:

a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

- **Tissue level of organization**

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

UNIT II **10 hours**

- **Integumentary system**

Structure and functions of skin

- **Skeletal system**

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

Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

- **Joints**

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

UNIT III **10 hours**

Body fluids and blood

Body fluids, composition and functions of blood, hemopoiesis, formation of haemoglobin, anaemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system

Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

UNIT IV **08 hours**

- **Peripheral nervous system:**

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

Origin and functions of spinal and cranial nerves.

- **Special senses**

  Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT V **07 hours**

Cardiovascular system

Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

Learning Experience

➢ Laboratory Work: Hands-on experience in labs where you study human tissues, organs, and systems, learning techniques for dissection, microscopy, and physiological measurements.

➢ Clinical Experience: Internships or co-op programs in medical or research settings, providing practical experience in understanding human anatomy, diagnosing conditions, and applying physiological principles in real-world scenarios.

➢ Research Skills: Understanding research methodologies and techniques used in anatomical and physiological studies, including data collection, analysis, and interpretation of results related to human health and disease.

Textbooks

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

4. Textbook of Medical Physiology- Arthur C, Guyton andJohn.E.Hall. Miamisburg, OH, U.S.A.

5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

Suggested Readings

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

4. Text book of Medical Physiology- Arthur C, Guyton andJohn.E.Hall. Miamisburg, OH, U.S.A.

5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

Open Educational Resources (OER)

1.https://www.carewellpharma.in/B_Pharmacy/Notes/1st_Sem/Human_Anatomy_and_Physiology-I

2. https://pharmshala.in/b-pharm-1st-semester-notes-in-pdf

3.https://www.thefuturepharmacist.com/2021/01/human-anatomy-and-physiology-i-download.html

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	

3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			100	

SEMESTER I					
BP102 T	**Pharmaceutical Analysis**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Chemistry				

Course Perspective

The pharmaceutical analysis course is important for pursuing career in quality control and quality assurance departments in various industries such as pharmaceutical, biotechnology, medical, food, chemical, etc. It prepares students with the skills needed to ensure the quality, safety, and efficacy of finished products.

Course Outcomes

Upon completion of the course student will be able to:

CO1: Understanding the basic analytical parameters and calculations.

CO2: Understanding the fundamental principles of volumetric and electrochemical analytical methods.

CO3: Applying various analytical methods for chemical analysis of organic and inorganic samples.

CO4: Analysing organic and inorganic sample through qualitative and quantitative analytical methods**.**

Course Content

UNIT-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

(c)Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.

UNIT-II **10 Hours**

Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **10 Hours**

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

Basic Principles,methods and application of diazotisation titration.

UNIT-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V **07 Hours**

Electrochemical methods of analysis

Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications.

Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

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

Learning Experience

This course will combine theoretical instruction and experiential learning to provide a comprehensive educational experience. Instruction will include lectures, interactive discussions, and multimedia presentations, supported by online resources and virtual simulations. Students will engage in case studies and group discussion to understand the theoretical concepts. Assessments will consist of quizzes, presentations sessional and end term exams. Additional support will be available through the LMS, while students are encouraged to collaborate and support each other through group work and peer reviews, which will enhance their learning and application of pharmaceutical analysis techniques.

Text and Reference Books

1. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition

4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia
8. British Pharmacopoeia

Suggested Readings

Open Educational Resources (OER)

1. https://www.youtube.com/watch?v=dLNsPqDGzms&t=9s
2. https://www.youtube.com/watch?v=DfKccOSwjMw
3. https://www.youtube.com/watch?v=sbAxgF4gvQk
4. https://www.youtube.com/watch?v=uut1HDUBEeA

Evaluation Scheme

Components	Sessional I and II	Continuous Mode	End Term Exam	Total
Weightage (%)	15	10	75	100

SEMESTER I					
BP103T	**Pharmaceutics-I**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**-**	**4**
Category of Course	Core				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites					

Course Perspective

This course provides a comprehensive understanding of the fundamental processes involved in creating and managing healthcare products. It also provides understanding of practical skills for preparing and handling various forms of medicines, emphasizing safety and effectiveness. It highlights the importance of quality in healthcare solutions and develops the ability to apply these principles in real-world scenarios. This course builds a strong foundation for future work in the pharmaceutical field.

Course Outcomes

Upon completion of the course the learner will be capable of

CO1: Understanding the essential processes involved in creating and managing healthcare products.

CO2: Applying the knowledge of the core concepts of drug formulation to effectively prepare and handle different forms of medicines.

CO3: Analyzing various preparations and their impact on the quality and effectiveness of pharmaceutical products.

CO4: Evaluating the importance of maintaining high standards in the development and delivery of healthcare solutions.

Course Content

Unit No: I **No. of Hours 10**

· **Historical background and development of profession of pharmacy:** History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

· **Dosage forms**: Introduction to dosage forms, classification and definitions · Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. · Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Unit No:II **No. of Hours 10**

· **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

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

· **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

Unit No:III **No. of Hours 8**

· **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

· **Biphasic liquids:** · Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. · Emulsions: Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

Unit No:IV **No. of Hours 8**

· **Suppositories:** Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

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

Unit No: V **No. of Hours 7**

· **Semisolid dosage forms**: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

Learning Experience This course will be conducted through a blend of interactive lectures, hands-on laboratory sessions, and group projects to ensure a comprehensive learning experience. Students will engage in case studies, problem-based learning, and practical experiments to apply theoretical knowledge in real-world scenarios, such as preparing pharmaceutical formulations and handling prescriptions. Technology, including virtual labs and e-learning platforms, will enhance understanding, while workshops, seminars, and field visits provide industry insights. Assessments will include quizzes, lab reports, practical exams, and group presentations. Continuous feedback will be provided, and the instructor will be available for additional support. Peer collaboration will be encouraged through group activities and peer reviews, fostering a supportive and interactive learning environment.

Textbooks

1. R. M. Mehta, Pharmaceutics-II, Vallabh Prakashan publishers, 2003, 286.

2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.

4. Lachmann. Theory and Practice of Industrial Pharmacy, Lea&Febiger Publisher, The University of Michigan.

5. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

6. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.

7. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

8. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

9. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.

10. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

11. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.

Suggested Readings

1. Indian Pharmacopoeia
2. British Pharmacopoeia

Open Educational Resources (OER)

1.https://www.longdom.org/proceedings/development-of-pharmacy-profession-in-india-and-amendments-in-drug-cosmetics-act-1940

2. https://pharmaedu.in/pharmaceutics-1-notes-pdf-download/

3. https://www.sciencedirect.com/science/article/abs/pii/B9780128200070000209

4.https://www.researchgate.net/publication/260210690_Basics_of_pharmaceutical_emulsions_A_review

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	--	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			100	

BP104T	PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)	L	T	P	C
		3	1	0	4
Version	2.0				
Pre-requisites/Exposure	Chemistry of drugs				
Co-requisites	Organic Chemistry				

Course perspective

This course for pharmacy students is designed to introduce the essential concepts, the therapeutic and diagnostic applications of inorganic chemistry within the pharmaceutical field. In the context of pharmacy, understanding inorganic chemistry is vital because many drugs, diagnostic agents, and excipients are inorganic compound.

Course outcomes

Understanding the basic properties of various inorganic compounds used in pharmaceuticals.

2. Understanding the environmental and health implications of inorganic compounds used in the pharmaceutical industry
3. Applying qualitative and quantitative analytical techniques for the identification and estimation of inorganic substances
4. Applying inorganic chemistry concepts in developing the pharmaceutical formulation

Course content

UNIT I

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

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

General methods of preparation, assay for the compounds superscripted with asterisk (*), properties and medicinal uses of inorganic compounds belonging to the following

UNIT-II **10 Hours**

Acids, Bases and Buffers:

Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Major extra and intracellular electrolytes:

Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Dental products:

Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

UNIT-III **10 Hours**

Gastrointestinal agents Acidifiers:

Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

UNIT-IV 8 Hours

Miscellaneous compounds

Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

Astringents: Zinc Sulphate, Potash Alum

UNIT-V 7 Hours

Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131 , Storage conditions, precautions & pharmaceutical application of radioactive substances

Text book

1. A.I. Vogel, Text Book of Quantitative Inorganic analysis

2. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3 rd Edition

3. M.L Schroff, Inorganic Pharmaceutical Chemistry

4. Bentley and Driver's Textbook of Pharmaceutical Chemistry

5. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

Reference Books/Materials

A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4

Online Reference

https://www.researchgate.net/publication/321938509_PHARMACEUTICAL_INORGANIC_CHEMISTRY_Gastrointestinal_agents_Acidifiers

https://www.sciencedirect.com/topics/medicine-and-dentistry/acid-base-balance

https://pubmed.ncbi.nlm.nih.gov/30130768/

Evaluation Scheme

Evaluation Scheme:				
-	**Evaluation Component**	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	

2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			100	

SEMESTER I					
BP105T	**COMMUNICATION SKILLS (Theory)**	**L**	**T**	**P**	**C**
Version ___	**2.0**	**2**	**0**	**0**	**2**
Category of Course	Core				

Total Contact Hours	30
Pre-Requisites/ Co-Requisites	

Course Perspective

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Course Outcomes

Upon completion of the course the learner will be able to:

CO1 Understanding the behavioral needs for a pharmacist to function effectively in the
areas of pharmaceutical operation
CO2 Applying the communication theories effectively during (Verbal and Non-Verbal) communication
CO3 Analysing the soft skills using the language moderation theories
CO4 Evaluating interview skills with mock and other methods
CO5 Creating the leadership qualities and essentials

Course Content

UNIT – I 07 Hours

Communication Skills: Introduction, Definition, The Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding,

Receiver, Feedback, Context

□□**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

□□**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II 07 Hours

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

□□**Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

43

UNIT – III 07 Hours

□□**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listening in Difficult Situations

□□**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

□□**Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV 05 Hours

□□**Interview Skills:** Purpose of an interview, Do's and Dont's of an interview

□□**Giving Presentations:** Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

□□**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition,Pearson Education, 2011

2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011

3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013

4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011

5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013

6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Greenhall, 1st Edition Universe of Learning LTD, 2010

7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011

8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press,2011

9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd,2011

10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc GrawHill Education, 2011

11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009

12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2024-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		5	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		35	
	Total		50	

Semester I					
BP 106RBT	Remedial Biology Theory	**L**	**T**	**P**	**C**
Version	**2.0**	**2**	**0**	**0**	**2**
Category of Course	Core				

Total Contact Hours	30
Pre-Requisites/ Co-Requisites	

Course Perspective

A course in remedial biology is designed to help students who may need additional support in understanding fundamental biological concepts. It provides a foundational understanding necessary for progressing in more advanced biological studies or related fields. Here's an overview of what such a course typically involves:

Course Outcomes

Upon completion of the course the learner will be able to:

CO1. Understanding the knowledge of various terminology applied in plant, animal & cellular biology

CO 2. Applying the knowledge of Anatomy and Physiology of plants and animals for the medicine

Course Content

UNIT I **7 Hours**

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature
- Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus**,**

Morphology of Flowering plants

- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.

UNIT II **07 Hours**

Body fluids and circulation

· Composition of blood, blood groups, coagulation of blood

· Composition and functions of lymph

· Human circulatory system

· Structure of human heart and blood vessels

· Cardiac cycle, cardiac output and ECG Digestion and Absorption

· Human alimentary canal and digestive glands

· Role of digestive enzymes

· Digestion, absorption and assimilation of digested food Breathing and respiration

· Human respiratory system

· Mechanism of breathing and its regulation

· Exchange of gases, transport of gases and regulation of respiration

· Respiratory volumes

UNIT III **07 Hours**

Excretory products and their elimination

· Modes of excretion

· Human excretory system- structure and function

· Urine formation

· Rennin angiotensin system Neural control and coordination

· Definition and classification of nervous system

· Structure of a neuron

· Generation and conduction of nerve impulse

· Structure of brain and spinal cord

· Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation

· Endocrine glands and their secretions

· Functions of hormones secreted by endocrine glands Human reproduction

· Parts of female reproductive system

· Parts of male reproductive system

· Spermatogenesis and Oogenesis

· Menstrual cycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

· Essential mineral, macro and micronutrients

· Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis

· Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNIT V **04 Hours**

Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development

· Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life

· Structure and functions of cell and cell organelles. Cell division Tissues

· Definition, types of tissues, location and functions.

Learning Experience

The learning experience of remedial biology is designed to help students build a solid foundation in biological concepts, especially if they are struggling with basic understanding or if they need a refresher before progressing to more advanced courses.

Organ Systems: Study the major organ systems in the human body, their functions, and how they interact.

Health and Disease: Learn about common diseases and their biological basis, along with basic health concepts.

Suggested Readings

a. Text book of Biology by S. B. Gokhale

b. b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Open Educational Resources (OER)

1.https://www.ncbi.nlm.nih.gov/books/NBK493197/

2.https://training.seer.cancer.gov/anatomy/respiratory/

Reference Books

a. A Text book of Biology by B.V. Sreenivasa Naidu

b. A Text book of Biology by Naidu and Murthy

c. Botany for Degree students By A.C.Dutta.

d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		5	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		35	
	Total		50	

SEMESTER II					
BP 106RMT	Remedial Mathematics	**L**	**T**	**P**	**C**
Version	**2.0**	**2**	**0**	**0**	**2**
Category of Course	Core				
Total Contact Hours	30				
Pre-Requisites/ Co-Requisites	Mathematics				

Course Perspective

This course is designed to strengthen foundational math skills, focusing on essential concepts such as algebra, geometry, and basic arithmetic. It aims to bridge gaps in understanding, helping students build confidence and competence in problem-solving. By reinforcing key mathematical principles, the course prepares students for more advanced topics, ensuring they have the tools necessary for success in their academic and professional pursuits.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1. Understanding the basic concept of arithmetic, algebra, and geometry.
CO 2. Applying the matrices and determinants to solve systems of linear equations.
CO 3. Analysing the algebra, geometry, and basic arithmetic
CO 4. Evaluating the results in real-life situations.

Course Content

UNIT I **7 Hours**

Partial fraction

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial, Fraction in Chemical Kinetics and Pharmacokinetics

Logarithms

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Function*:*

Real Valued function, Classification of real valued functions,

Limits and continuity:

Introduction, Limit of a function, Definition of limit of a function

UNIT II **07 Hours**

Matrices and Determinant:

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix

method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations

UNIT III **07 Hours**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n *w.r.t* x,where n is any rational number, Derivative of e^x,, Derivative of loge x, Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT IV **05 Hours**

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT V **04 Hours**

Differential Equations: Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations

Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical, kinetics and Pharmacokinetics equations

Textbooks

a. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
b. A Text Book of Remedial Mathematics by P. Seshagiri Rao.

Suggested Readings

a. Differential Calculus by Shanthinarayan
b. Higher Engineering Mathematics by Dr.B.S.Grewal
c. Integral Calculus by Shanthinarayan

Open Educational Resources (OER)

a. https://openstax.org/books/prealgebra/pages/1-introduction

b. https://www.khanacademy.org/math/arithmetic

c. https://learn.saylor.org/course/view.php?id=39

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/ Extempore)		5	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		35	
	Total		50	

Semester I					
BP 107 P	Human Anatomy and Physiology-I (Practical)	**L**	**T**	**P**	**C**
Version	**2.0**	0	0	4	2
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Pharmacology/ Pathophysiology				

Course Perspective

This course is centered on providing students with a foundational understanding of the human body's structure and function, which is crucial for careers in healthcare, medicine, and related fields. It emphasizes the integration of theoretical knowledge with practical experience, allowing students to explore the complex interactions between different organ systems and their physiological processes.

Course outcomes

Upon completion of the course the learner will be able to:

CO1. Understanding the gross morphology, structure, and functions of various organs of the human body

CO 2. Applying the various homeostatic mechanisms and their imbalances pertinent to life cycles.

CO 3. Analysing the various tissues and organs of different systems of human body and pathological changes.

CO 4. Evaluating the various experiments parameters related to gross morphology, structure, and functions of various organs of the human body

Course Content

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.

13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of Blood Pressure

Learning Experience

The practical learning experience help develop essential skills such as observation, analysis, and critical thinking. They also encourage teamwork and collaboration, as students work together to perform experiments and solve anatomical problems. This experiential learning ensures that students can apply their knowledge to clinical settings, making it a vital part of their education in health and life sciences.

1. Hands-on experience with dissections, microscopy, and physiological experiments.
2. Deeper understanding of human body structure and function.
3. Reinforcement of theoretical knowledge through real-life application.
4. Development of critical observation and analytical skills.
5. Enhancement of teamwork and collaboration during practical sessions.
6. Exposure to clinical relevance, preparing for healthcare and medical applications.
7. Improved problem-solving abilities related to human anatomy and physiology.

Textbooks

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers' medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
4. Textbook of Medical Physiology- Arthur C, Guyton andJohn.E.Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother’s medical publishers, New Delhi.

Reference Books

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Textbook of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata
4. Difore S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia

Open Educational Resources (OER)

1. https://microbenotes.com/compound-microscope-principle-instrumentation-and-applications/
2. https://app.jove.com/science-education/v/11985/concepts/blood-types
3. https://chemometec.com/how-to-count-cells-with-a-hemocytometer/#:~:text=Place%20the%20hemocytometer%20under%20the,the%20number%20of%20dead%20cells.

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage(%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		05	
2	Sessional I/II Examination (Written Examination)	1 hours	10	
3	End Term Examination (Written Examination)	3 hours	35	

	Total	50	

BP 108 P	**Pharmaceutical Analysis Practical**	**L**	**T**	**P**	**C**
Version	**2.0**	0	0	4	2
Category of Course	Core				
Total Contact Hours	60 hours				
Pre-Requisites/ Co-Requisites	Analytical Chemistry				

Course Perspective

Pharmaceutical Analysis-I practical is a foundational course designed to provide students with essential analytical skills for ensuring the quality, safety, and efficacy of pharmaceutical products. These practical manual titles to bridge the gap between theoretical knowledge and practical application, offering students a comprehensive guide to mastering various pharmaceuticals analytical techniques.

Course Outcomes

CO1. Understanding the pharmaceutical analysis techniques.

CO2. Applying the pharmaceutical analysis concept to standardize solutions with accuracy and precision.

CO3. Analysing the titration data to assess product quality.

CO4. Evaluating and minimize errors in pharmaceutical analysis.

Course Content:

S. No.	Experiment
1.	A. Orientation for practical handling in pharmaceutical laboratory
	B. Demonstration of handling of acid and gaseous liquid
2.	A. Introduction of chemical hazards & handling in pharmaceutical chemistry laboratory
	B. Prepare and submit list of hazardous chemicals present in assigned pharmaceutical laboratory
3.	Limit test for chloride
4.	Limit test for sulphate
5.	Limit test for iron
6.	Preparation and standardization of 0.1N NaOH
7.	Preparation and standardization of 0.1M H_2SO_4
8.	Preparation and standardization of 0.1M Sodium thiosulphate
9.	Preparation and standardization of 0.02M Potassium permanganate
10.	Assay of ammonium chloride
11.	Assay of boric acid
12.	Assay of Calcium gluconate
13.	Assay of Copper sulphate

14.	Assay of Hydrogen peroxide
15.	Assay of Ferrous sulphate
16.	Assay of Sodium chloride by precipitation titration
17.	Assay of strong acid against strong base by conductometric titration

Reference Books

1. Beckett & J.B. Stenlake, Practical Pharmaceutical Chemistry
2. A.I. Vogel, Textbook of Quantitative Inorganic analysis
3. B.K. Sharma, Instrumental Methods of Chemical Analysis by B.K. Sharma
4. Y.R. Sharma, Organic Spectroscopy by Y.R. Sharma
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. P.D. Sethi, Quantitative analysis of Drugs in Pharmaceutical Formulations
7. John H. Kennedy, Analytical chemistry principles
8. Indian Pharmacopoeia

Evaluation Scheme

Components	Sessional I and II	Continuous Mode	End Term Exam	Total
Weightage (%)	**10**	**5**	**35**	**50**

SEMESTER I					
BP109P	**Pharmaceutics-I Practical**	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**-**	**4**	**2**
Category of Course	Core Course				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites					

Course Perspective This course provides the essential hands-on skills in the preparation and handling of healthcare products. It emphasizes the importance of safety and quality in practical applications, fostering an understanding of the processes involved in product formulation. This course also encourages innovative thinking to develop and implement new approaches in pharmaceutical practice, ultimately contributing to improved healthcare solutions.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1. Understanding the fundamental processes involved in the preparation and handling of healthcare products.

CO2. Observing and evaluating different techniques to identify factors influencing product quality and performance.

CO3. Imitating the skills in the preparation and formulation of various healthcare products while ensuring safety and quality.

CO4. Evaluating the practical outcomes through testing methods and interpreting results to ensure compliance with expected standards.

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Course Content

1 Syrups

Syrup IP'66

Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

Piperazine citrate elixir

Paracetamol pediatric elixir

3.Linctus

Terpin Hydrate Linctus IP'66

4. Solutions

Iodine Throat Paint

Mandles Paint

Strong solution of ammonium acetate

Cresol with soap solution

Lugol's solution

5. Suspensions

Calamine lotion

Magnesium Hydroxide mixture

Aluminimum Hydroxide gel

6. Emulsions a

Turpentine Liniment

Liquid paraffin emulsion

7. Powders and Granules

ORS powder (WHO)

Effervescent granules

Dusting powder

Divded powders

8. Suppositories

Glycero gelatin suppository

Cocoa butter suppository

Zinc Oxide suppository

9. Semisolids

Sulphur ointment

Non-staining-iodine ointment with methyl salicylate

Carbopal gel

10. Gargles and Mouthwashes

Iodine gargle

Chlorhexidine mouthwash

Learning Experience

➢ Laboratory Work: Hands-on experience in labs, where you might work on drug formulation, quality control, and manufacturing processes.

➢ Industry Experience: Internships or co-op programs in pharmaceutical companies, providing real-world experience in drug development, production, and quality assurance.

➢ Regulatory Knowledge: Understanding the regulatory environment and compliance requirements for drug approval and manufacturing.

Textbooks

1. R. M. Mehta, Pharmaceutics-II, Vallabh Prakashan publishers, 2003, 286.

2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.

4. Lachmann. Theory and Practice of Industrial Pharmacy, Lea&Febiger Publisher, The University of Michigan.

5. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

6. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.

7. E.A. Rawlins, Bentley's Textbook of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

8. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

9. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.

10. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

11. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.

Suggested Readings

1. Indian Pharmacopoeia
2. British Pharmacopoeia

Open Educational Resources (OER)

1.https://www.longdom.org/proceedings/development-of-pharmacy-profession-in-india-and-amendments-in-drug-cosmetics-act-1940

2. https://pharmaedu.in/pharmaceutics-1-notes-pdf-download/

3. https://www.sciencedirect.com/science/article/abs/pii/B9780128200070000209

4.https://www.researchgate.net/publication/260210690_Basics_of_pharmaceutical_emulsions_A_review

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**

1	**Continuous Assessment (Practical Record/Viva)	-	5	
2	Sessional Examination (Written Examination)	3 hr	10	
3	End Term Examination (Written Examination)	3 hr	35	
Total			**50**	

SEMESTER I					
BP110 P	**Pharmaceutical Inorganic Chemistry (practical)**	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**-**	**4**	**2**

Category of Course	Core Course
Total Contact Hours	45 hours
Pre-Requisites/ Co-Requisites	

Course Perspective:

Pharmaceutical inorganic chemistry deals with application of inorganic compounds within the pharmaceutical industry. In this course students will develop a comprehensive skill set in conducting essential pharmaceutical quality control tests, synthesizing inorganic compounds, and ensuring their compliance with pharmacopeial standards. This practical knowledge is invaluable for ensuring the safety, efficacy, and quality of pharmaceutical products, preparing students for careers in pharmaceutical analysis, quality assurance, and formulation development.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding of the chemical reactions and mechanisms involving inorganic compounds, particularly those relevant to drug formulation and action

CO 2: Applying basics of pharmaceutical organic chemistry in the preparation, purification, and identification of inorganic compounds commonly used in pharmaceuticals.

CO 3: Analysing techniques, such as titrimetry, gravimetry, and spectrophotometry, to quantitatively and qualitatively analyze inorganic substances.

CO4: Evaluation of the purity of substances like bentonite, aluminum hydroxide gel, and potassium iodide by conducting specific purity tests and interpreting the results.

CO5: Synthesizing inorganic compounds to be used for different pharmaceutical preparation

Syllabus

1. **Limit tests for following ions**

   Limit test for Chlorides and Sulphates

   Modified limit test for Chlorides and Sulphates

   Limit test for Iron

   Limit test for Heavy metals

   Limit test for Lead

   Limit test for Arsenic

2. **Identification test**

   Magnesium hydroxide

   Ferrous sulphate

   Sodium bicarbonate

   Calcium gluconate

   Copper sulphate

3. **Test for purity**

   Swelling power of Bentonite

   Neutralizing capacity of aluminum hydroxide gel

   Determination of potassium iodate and iodine in potassium Iodide

4. **Preparation of inorganic pharmaceuticals**

   Boric acid

Potash alum

Ferrous sulphate

Learning outcomes

1. Students will be able to synthesize various inorganic compounds used in pharmaceuticals, following standard laboratory procedures.
2. Students will be able to perform qualitative and quantitative analyses to identify and determine the purity of pharmaceutical inorganic substances.
3. Students will be able to safely and effectively use laboratory equipment, such as balances, burettes, pipettes, and heating apparatus, for inorganic chemistry experiments.
4. Students will be able to standardize solutions, such as acids, bases, and other reagents, for use in titrations and other analytical procedures.
5. Students will be able to interpret the results of experiments, comparing them to pharmacopeial standards to ensure the quality and purity of pharmaceutical inorganic substances.

Textbooks

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. M.LSchroff, Inorganic Pharmaceutical Chemistry

Open Educational Resources (OER)

1. **https://jru.edu.in/studentcorner/lab-manual/bpharm/1st-sem/Pharmaceutical%20Inorganic%20Chemistry.pdf**
2. **https://chemistlibrary.wordpress.com/wp-content/uploads/2015/05/practical-inorganic-chemistry-1984-vorobyova-dunaeva-ippolitova-tamm**
3. **https://people.iitism.ac.in/~download/lab%20manuals/chemistry_chembio/CYC%20506%20Inorganic%20Chemistry%20MSC%201st%20SEM.pdf**

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	2	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	4 hr.	35	
Total			50	

SEMESTER I					
BP111P	**COMMUNICATION SKILLS Practical**	**L**	**T**	**P**	**C**
Version	**2**	**2**	**0**	**0**	**1**
Category of Course	Core				
Total Contact Hours	30				
Pre-Requisites/ Co-Requisites					

Course Perspective

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a teamplayer and will add value to the pharmaceutical business

Course Outcomes

Upon completion of the course the learner will be able to:

CO1 Understanding the behavioural needs for a pharmacist to function effectively in the
areas of pharmaceutical operation
CO2 Applying the communication for upskilling
CO3 Analysing the communication skills to manage interpersonal skills and the team as a team player

Course Content

Basic communication covering the following topics
Meeting People
Asking Questions
Making Friends
What did you do?
Do's and Dont's
Pronunciations covering the following topics
Pronunciation (Consonant Sounds)
Pronunciation and Nouns
Pronunciation (Vowel Sounds)
Advanced Learning
Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011

2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011

3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013

4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011

5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala

Swamy Ramesh, 5thEdition, Pearson, 2013

6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green

hall, 1st Edition Universe of Learning LTD, 2010

7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011

8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press,2011

9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd,2011

10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc GrawHill Education, 2011

11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009

12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2024-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		5	
2	Sessional I/II Examination (Written Examination)		5	
3	End Term Examination (Written Examination)		15	
	Total		25	

SEMESTER I					
BP 112 RBP	Remedial Biology Practical	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**0**	**2**	**1**
Category of Course	Core				
Total Contact Hours	30				
Pre-Requisites/ Co-Requisites					

Course Perspective

Remedial Biology Practical" course is designed to help students strengthen their foundational knowledge and practical skills in biology

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understand the handling of microscope and permanent slide preparation techniques.

CO2: Comprehend and identify tissue organization in plants and animals.

CO3: Study different diagnostic procedures.

Course Content

1. Introduction to experiments in biology

a) Study of Microscope **2 Hours**

b) Section cutting techniques **1 Hours**

c) Mounting and staining **1 Hours**

d) Permanent slide preparation **2 Hours**

2. Study of cell and its inclusions **2 Hours**

3. a)Study of Stem **2 Hours**

b)Root **2 Hours**

c)Leaf **2 Hours**

d)seed **1 Hours**

e)Fruit **1 Hours**

f) flower and their modifications **2 Hours**

4. Detailed study of frog by using computer models **2 Hours**

5. a) Microscopic study and identification of tissues pertinent to Stem, Root Leaf, **1 Hours**

b)Microscopic study and identification of tissues pertinent to seed, fruit and flower **1 Hours**

6. Identification of bones **2 Hours**

7. Determination of blood group **2 Hours**

8. Determination of blood pressure **2 Hours**

9. Determination of tidal volume **2 Hours**

Learning Experience

The learning experience of remedial biology is designed to help students build a solid foundation in biological concepts, especially if they are struggling with basic understanding

- **Organ Systems:** Study the major organ systems in the human body, their functions, and how they interact.
- **Health and Disease:** Learn about common diseases and their biological basis, along with basic health concepts.

Suggested Readings

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi

Open Educational Resources (OER)

1.https://www.ncbi.nlm.nih.gov/books/NBK493197/

2.https://training.seer.cancer.gov/anatomy/respiratory/

Reference Books

a. A Text book of Biology by B.V. Sreenivasa Naidu

b. A Text book of Biology by Naidu and Murthy

c. Botany for Degree students By A.C.Dutta.

d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		5	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		35	
4	Total	50		

SEMESTER II						
BP 201 T	**Human Anatomy and Physiology (Theory)**	**L**	**T**	**P**	**S**	**C**
Version	**2.0**	**3**	**1**	**0**	**0**	**4**
Category of Course	Core Course					
Total Contact Hours	45 Hours					
Pre-Requisites/Co-Requisites	Biology					

Course Perspective:

The course on Human Anatomy and Physiology provides an understanding of the body's structure and function. It offers a comprehensive analysis of the human body's structural and functional organization, emphasizing the intricate relationship between systems, organs, and cellular processes. It explores the dynamic interplay between anatomical form and physiological function, with a focus on homeostatic regulation and its role in maintaining systemic equilibrium.

Course Outcomes

Upon completion of this course the student should be able to

1. Understanding the gross morphology, structure, and functions of various organs of the human body.
2. Applying knowledge to physiology and the various homeostatic mechanisms and their imbalances.
3. Analyzing receptor functions and physiological processes to understand the interactions of bodily systems at the molecular and cellular levels.

4. Evaluating the mechanism of hormone action, structure, and functions of different glands.

Syllabus

UNIT I **(Lectures- 10)**

Nervous system

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts,reflex activity)

UNIT II **(Lectures- 6)**

Digestive system

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics

Formation and role of ATP, Creatinine Phosphate and BMR**.**

UNIT III **(Lectures- 10)**

Respiratory system

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration.

Lung Volumes and capacities transport of respiratory gases, artificial respiration,and resuscitation methods**.**

Urinary system

Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

UNIT IV **(Lectures- 6)**

Endocrine system

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

UNIT V **(Lecture -9)**

Reproductive system

Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

Introduction to genetics

Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

Learning experience:

Human Anatomy and Physiology offers a detailed understanding of how the body functions, starting with the organization of the nervous system, including neurons, nerve fibers, synapses, and neurotransmitters, along with the structure and roles of the brain and spinal cord. The digestive system covers the anatomy of the GI tract and the processes of digestion and nutrient absorption. Respiratory and urinary systems focus on lung function, gas exchange, kidney functions, and urine formation. The endocrine system explains hormone regulation and gland functions, while the reproductive system covers reproductive anatomy and processes like menstruation and pregnancy. The introduction to genetics provides a foundation in DNA, genes, and inheritance patterns, offering a well-rounded understanding of the body's systems.

Textbook

1. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.

2. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
3. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
4. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

Reference Books/Materials

1. Tortora GJ, &Anagnodokos NP ―Principles of Anatomy & Physiology‖, Harper & Row,
2. Guyton AC, Hall JE., ―Text book of Medical Physiology‖, WB Saunders Company
3. *Ross & Wilson ―Anatomy & Physiology in Health & Illness‖, Churchill Livingstone*

Online Reference

1. https://my.clevelandclinic.org/health/articles/21202-nervous-system
2. https://my.clevelandclinic.org/health/articles/9118-female-reproductive-system
3. https://www.slideshare.net/slideshow/endocrine-system-1-73527168/73527168
4. https://www.slideshare.net/pallavi333/anatomy-and-physiology-of-endocrine-system-242754627

Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**

1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		10	
2	Mid Term Examination (Written Examination)	60 Minutes	15	
3	Attendance			
4	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

SEMESTER II					
BP202T	Pharmaceutical Organic Chemistry I – Theory	**L**	**T**	**P**	**C**
Version:	**2.0**	**3**	**1**	**0**	**4**

Category of Course	Core
Total Contact Hours	60
Pre-Requisites/ Co-Requisites	Organic Chemistry

Course Perspective: This course equips students with a comprehensive understanding of the classification, nomenclature, and structural isomerism of organic compounds, essential for the field of pharmaceutical sciences. It delves into the formation of reaction intermediates, key physical properties, and various methods for synthesizing organic compounds. The course places significant emphasis on reaction mechanisms and orientation, offering participants a deeper insight into the fundamental principles that drive organic reactions.

Course Outcomes:

Upon completion of the course the learner will be able to:

CO 1: Understanding basic concepts associated with organic functional groups and their pharmaceutical uses.

CO 2: Applying concepts of organic chemical structure, bonding and stability to predict and explain patterns in shape, structure, bonding, hybridization, formal charge, stability, acidity, basicity, solubility, and reactivity for hydrocarbons, alkenes, dienes, alkyl halides, alcohols, carbonyl compounds, carboxylic acids and amines.

CO 3: Applying concepts associated with fundamental organic reactions like substitution, elimination, addition, rearrangement, cycloaddition, ring-opening, and radical halogenation to product prediction, identification, synthesis design, and reaction mechanism.

CO 4: Analysing and draw logical mechanism and intermediates to predict products of related reactions.

CO 5: Evaluating the structure of small organic compounds includes isomers, naming, conformations, and stereochemistry

Course Content

- General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained.

- To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

Syllabus

Unit No 1: Classification, nomenclature and isomerism No. of Hours: 07

- Classification of Organic Compounds: Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences carbocyclic compounds)
- Structural isomerism's in organic compounds.

Unit No 2: Alkanes*, Alkenes* and Conjugated dienes* No. of Hours: 10

- SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.
- Stabilities of alkenes, SP^2 hybridization in alkenes
- E_1 and E_2 reactions: kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions.
- Ozonolysis, electrophilic reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.
- Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

Unit No 3: Alkyl halides* and Alcohols* No. of Hours: 10

- SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions.
- Structure and uses of ethyl chloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.
- qualitative tests, structure and uses of ethyl alcohol, methyl alcohol, chlorobutanol, cetosteryl alcohol, benzyl alcohol, glycerol, propylene glycol.

Unit No 4: Carbonyl compounds* (Aldehydes and ketones) No. of Hours: 10

- Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation.
- Qualitative tests, structure and uses of formaldehyde, paraldehyde, acetone, chloral hydrate, hexamine, benzaldehyde, vanilin, cinnamaldehyde.

Unit No 5: Carboxylic acids* and aliphatic amines* No. of Hours: 08

- Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester.
- Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid.
- Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

Learning Experience: This course will be conducted through a blend of lectures, hands-on laboratory sessions during practical course, and interactive group work to provide a comprehensive learning experience. Instructional methods will include detailed lectures on classification of organic compounds, identification and concept of organic reaction mechanism reinforced by multimedia presentations and virtual lab simulations to illustrate complex concepts. Group activities, including case studies and collaborative problem-solving exercises, will enhance peer learning and teamwork skills. Assignments will involve real-world applications, challenging students to devised logical and detailed mechanisms and draw meaningful conclusions.

Text Books

1. Organic Chemistry by Morrison and Boyd
2. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
3. Organic Chemistry by P.L.Soni

Reference Books/Materials

1. Organic Chemistry by I.L. Finar , Volume-I
2. Vogel’s text book of Practical Organic Chemistry
3. Advanced Practical organic chemistry by N.K.Vishnoi.
4. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

5. Reaction and reaction mechanism by Ahluwaliah/Chatwal

Open Educational Resources (OER)

1. Swayam course: Introductory Organic Chemistry I by Prof. Neeraja Dashaputre and Prof. Harinath Chakrapani
2. Swayam course: Introductory Organic Chemistry II by Prof. Neeraja Dashaputre and Prof. Harinath Chakrapani
3. Swayam course: Basic Organic Chemistry by Prof. Tharmalingam Punniyamurthy

Evaluation Scheme:

S. No.	Evaluation Component	Duration	Weightage (%)
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		10
2	Sessional I/II Examination (Written Examination)	1 h	15
3	End Term Examination (Written Examination)	3 h	75

Total	**100**

SEMESTER II						
BP203T	**Biochemistry – Theory**	**L**	**T**	**P**	**S**	**C**
Version	**2.0**	**3**	**1**	**0**	**0**	**4**
Category of Course	Core Course					
Total Contact Hours	45 Hours					
Pre-Requisites/Co-Requisites	General Chemistry					

Course Perspective: The Biochemistry course provides a comprehensive overview of different biomolecules & emphasizing their biological roles. The subject encompasses the biochemical facts and principles necessary to comprehend the metabolism of nutrient molecules under physiological and pathological conditions.

Course Outcomes

Upon completion of this course the student should be able to

CO1. Understanding fundamental knowledge of the structure, function, and significance of various biomolecules.

CO2. Applying expertise in the synthesis of different biomolecules.

CO3. Analyzing various metabolic pathways of carbohydrates, lipids, amino acids, and nucleic acids.

CO4. Evaluating the catalytic role of enzymes and importance of enzyme inhibitors in design of new drugs.

Course Content

UNIT I **Lectures- 08 Hours**

Biomolecules Introduction, classification, chemical nature and biological role of Bioenergetics:•carbohydrate, lipids, nucleic acids, amino acids and proteins. Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP Carbohydrate metabolism•

UNIT II **Lectures- 10 Hours** Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance biological oxidation Hormonal regulation of blood glucose level and Diabetes mellitus Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers level Lipid metabolism

UNIT III **Lectures- 10 Hours**

β-Oxidation of saturated fatty acid (Palmitic acid) 61 Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, Amino acid metabolism•fatty liver and obesity. General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice Nucleic acid metabolism and genetic information transfer

UNIT IV **Lectures- 10 Hours**

Biosynthesis of purine and pyrimidine nucleotides and Catabolism of purine nucleotides Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors 62 Enzymes•

UNIT V **Lectures- 07 Hours**

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

Learning experience: Biochemistry offers a detailed understanding of biomolecules such as carbohydrates, lipids, proteins, nucleic acids, and amino acids, along with their biological roles. Bioenergetics explores free energy concepts, redox potential, and the importance of ATP and cyclic AMP. Carbohydrate metabolism includes pathways like glycolysis, the citric acid cycle, gluconeogenesis, and the regulation of blood glucose, with a focus on diseases like diabetes and glycogen storage disorders. Lipid metabolism covers fatty acid oxidation, cholesterol metabolism, and related disorders like atherosclerosis. Amino acid metabolism discusses transamination, deamination, and disorders such as phenylketonuria. Nucleic acid metabolism explains DNA and RNA functions, replication, transcription, and protein synthesis.

Text Books

1. Principles of Biochemistry by Lehninger.
2. Harper’s Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.

3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.

Reference Books/Materials

1. Textbook of Biochemistry by Deb.
2. Outlines of Biochemistry by Conn and Stump

Online Reference

1. https://www.pharmaguideline.com/2021/11/introduction-classification-chemical--nature-and-biological-role-of-nucleic-acid.html
2. https://www.khanacademy.org/science/ap-biology/chemistry-of-life/properties-structure-and-function-of-biological-macromolecules/a/hs-biological-macromolecules-review
3. https://bio.libretexts.org/Under_Construction/Purgatory/Core_(Britt's_page)/Endergonic_and_Exergonic_Reactions%23
4. https://www.pharmaguideline.com/2021/11/concept-of-free-energy-endergonic-and-exergonic-reaction.html
5. https://content.patnawomenscollege.in/microbiology/1588051458289_CC203%20Energy%20rich%20compounds.pdf

Examination Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/Attendance/Student-teacher interaction/ Extempore)	-	10	

2	Sessional Exam (Written Examination)	60 Minutes	15	
3	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

BP 204 T	Pathophysiology	**L**	**T**	**P**	**S**	**C**
Version	**2.0**	**3**	**1**	**0**	**0**	**4**
Total contact hours	**45**					
Pre-requisites/Exposure	HAP-I					
Co-requisites	Pharmacology-I					

Course Perspective

This course focused on pathophysiology, which is the study of how diseases affect bodily functions

Course outcomes

Upon completion of this course the student should be able to

CO 1 Understanding the etiology and pathogenesis of the selected diseases principles of Cell injury and Adaptation

CO 2 Applying the knowledge to explore the types of injuries encountered during life.

CO 3 Analysing the causatives organism of various diseases and pathogenesis

CO 4 Evaluating the lifestyle disorders

SYLLABUS

Unit I **(Hours-10)**

Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage),Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia),Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

Unit II **(Hours-10)**

- **Cardiovascular System:** Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)
- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure

Unit III **(Hours-10)**

- **Haematological Diseases:** Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer

Unit IV **(Hours-10)**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.

- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer
- **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis,Gout
- **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

Unit V **(Hours-10)**

- **Infectious diseases:** Meningitis,Typhoid, Leprosy, Tuberculosis
- Urinary tract infections
- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea

Textbook

1 Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.

2 Harsh Mohan; Text book of Pathology; 6 th edition; India; Jaypee Publications; 2010.

3 Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis ofTherapeutics; 12 th edition; New York; McGraw-Hill; 2011.

4 Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;

5 Sharma Suresh C: Understanding of human diseases; BSA, Prakshan, New Delhi, Ist Edt

Reference Books/Materials

[1] Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9 th edition; London; McGraw-Hill Medical; 2014.

[2] V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6 th edition; Philadelphia; WB Saunders Company; 1997.

[3] Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3 rd edition; London; Churchill Livingstone publication; 2003.

[4] Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.

Online Reference:

1. http://emedicine.medscape.com/
2. https://www.elsevier.com/journals/pathophysiology/0928-4680?generatepdf=true
3. https://en.wikipedia.org/wiki/Pathology
4. https://webpath.med.utah.edu/EXAM/EXAMIDX.htmlhttps://www.slideshare.net/arijabuhaniyeh/gi-drugs-pharmacology
5. https://www.slideshare.net/Shivam1995Diwaker/pharmacology-of-free-radicals
6. https://www.msdmanuals.com/en-in/professional/neurologic-disorders/delirium-and-dementia/alzheimer-disease#:~:text=Pathophysiology%20of%20Alzheimer%20Disease&text=The%20beta%2Damyloid%20deposition%20and,at%20the%20mesial%20temporal%20lobe.
7. https://notesmed.com/wp-content/uploads/2020/08/Essentials-of-Medical-Pharmacology-8th-Edition..pdf
8. https://www.slideshare.net/meducationdotnet/clinical-pharmacology-therapeutics-revision-notes
9. https://ocw.mit.edu/courses/hst-151-principles-of-pharmacology-spring-2005/pages/lecture-notes/
10. https://www.mypharmaguide.com/pharmacology-pdf-notes-free-download/
11. https://www.thefuturepharmacist.com/2021/06/pharmacology-i-theory-bp-404-t-semester.html
12. https://www.researchgate.net/publication/325069109_Unit_I_PHARMACOLOGY_TOXICOLOGY
13. https://medicalsciences.med.unsw.edu.au/sites/default/files/soms/page/Undergrad/2013-PHAR2011-course-outline.pdf
14. https://www.physio-pedia.com/Pharmacological_management_of_Diabetes_Mellitus
15. https://www.nature.com/articles/nrendo.2016.86

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date, Time & Venue
1	Written Examination (Sessional I and II)	60 Minutes	15	
2	Continuous Mode		10	
3	End Term Examination	180 Minutes	75	
Total			**100**	

BP205T	Computer Applications in Pharmacy	L	T	P	C

Version	**2.0**	**3**	**1**	**0**	**4**
Total hours	**45**				
Pre-requisites/Exposure	**Mathematics**				
Co-requisites	**Computer education**				

Course perspective

This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

Course outcomes (cos)

Upon completion of this course the student will be understanding

CO1 Understanding the various types of application of computers in pharmacy

CO 2 Applying the software application to databases and results

CO 3 Analyzing the various applications of databases in healthcare

Course content:

UNIT – I **06 hours**

Number system: Binary number system, Decimal number system, Octalnumber system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division

Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and

UNIT –II 06 hours

Web technologies:Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and ServerProducts Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III 06 hours

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System,Pharma Information System

UNIT – IV 06 hours

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

UNIT-V 06 hours

Computers as data analysis in Preclinical development: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins –

Wiley-Interscience, A John Willey and Sons, INC., Publication, USA

3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers andDistributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server,DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002

Learning outcome

This structure ensures a comprehensive understanding of both theoretical concepts and practical applications, preparing students for real-world challenges in the pharmacy and healthcare sectors.

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	

3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			**100**	

BP206T	**Environmental Sciences (Theory)**	**L**	**T**	**P**	**C**
Version	2.0	**3**	**0**	**0**	**3**
Total Contact Hours	30 Hours				
Pre-requisites/Exposure	Environmental studies				
Co-requisites	Social and cultural factors				

Course perspective

The Environmental Science course appears to offer a comprehensive introduction to key environmental issues and concepts and fosters a broader awareness of the interplay between human activities and the environment.

Course Outcomes (CO)

On completion of this course, the student will be able to:

CO1. Understanding environmental system and the status of its inherent or induced changes on organisms.

CO 2. Applying environmental laws to protect nature

CO3. Analyzing human participation in environment protection and environment improvement.

CO 4. Evaluating the different environmental rules and regulations of their correlation with allied problems

Course content:

Unit-I **10hours**

The Multidisciplinary nature of environmental studies

Natural Resources Renewable and non-renewable resources:

Natural resources and associated problems

a) Forest resources;

b) Water resources;

c) Mineral resources;

d) Food resources;

e) Energy resources;

f) Land resources:

Role of an individual in conservation of natural resources.

Unit-II **10hours Ecosystems**

Concept of an ecosystem.

Structure and function of an ecosystem.

Introduction, types, characteristic features, structure and function of the ecosystems:

Forest ecosystem;

Grassland ecosystem;

Desert ecosystem;

Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- III **10hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Learning Experience:

The students will gain a solid foundation in environmental science and be better equipped to address environmental challenges in their professional and personal lives. This may include:

Develop a Comprehensive Understanding of Environmental Issues:

Gain a thorough knowledge of environmental science principles and their applications. Appreciate the complexity and interconnectivity of environmental systems and human impacts.

Foster Critical Thinking and Problem-Solving Skills:

Cultivate the ability to analyse environmental problems critically and propose effective solutions. Enhance problem-solving skills through case studies, projects, and practical applications.

Promote Awareness and Responsibility:

This build awareness of environmental issues and the importance of sustainable practices. Encourage responsible behaviour and advocacy for environmental conservation and protection.

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. 2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment
8. Down of Earth, Centre for Science and Environment

Open Education Resources (OER)

1. **https://alg.manifoldapp.org/projects/introduction-to-environmental-science**
2. **https://pressbooks.nscc.ca/enviroscience/**

Evaluation Scheme

Sr. No.	Evaluation component	Duration	Weightage (%)	Date
1	**Continuous assessment (Quiz/Assignment/Presentation/Extempore)	-	10	-
2	Sessional I/II Examination (Written Examination)	1 Hr.	15	-
3	End Term Examination (Written Examination)	2 Hrs.	50	-
	Total		75	

Semester II					
BP207P	**Human Anatomy & Physiology Practical**	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**-**	**4**	**2**
Category of Course	Practical				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Human Anatomy & Physiology, Biology				

Course Perspective

This course offers a comprehensive study of the human body's systems and functions through practical experience. It integrates the theoretical knowledge of human physiology with hands-on learning, helping students understand the body's mechanisms in real-world scenarios. By the end of the course, students

will have a deeper understanding of human physiology and will be able to apply this knowledge in both academic and clinical settings. This course is essential for students aiming to build careers in healthcare, pharmacy, and biomedical fields. It equips them with the skills required for patient care, diagnostics, and understanding the physiological basis of human health and disease.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding structure and function of various body systems using specimens and models.

CO2: Applying basic physiological tests, such as neurological exams and sensory system assessments.

CO3: Analysing physiological parameters like body temperature, tidal volume, and reflex activity

CO4: Evaluate physiological parameters to the feedback mechanisms that regulate body functions.

Course Content **4 Hours/week**

1. To study the integumentary and special senses using specimen, models, etc.

2. To study the nervous system using specimen, models, etc.

3. To study the endocrine system using specimen, models, etc

4. To demonstrate the general neurological examination

5. To demonstrate the function of olfactory nerve

6. To examine the different types of taste.

7. To demonstrate the visual acuity

8. To demonstrate the reflex activity

9. Recording of body temperature

10. To demonstrate positive and negative feedback mechanism.

11. Determination of tidal volume and vital capacity.

12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.

13. Recording of basal mass index.

14. Study of family planning devices and pregnancy diagnosis test.

15. Demonstration of total blood count by cell analyser

16. Permanent slides of vital organs and gonads.

Learning Experience

This course will utilize a combination of **practical lab work**, **demonstrations**, and **interactive discussions** to provide a hands-on learning experience. Students will engage in activities such as:

- **Specimen Studies**: Observation and examination of real specimens to understand human physiology.
- **Model-Based Learning**: Interactive study of anatomical models for better visualization of complex systems.
- **Functional Tests**: Conducting neurological exams, reflex tests, and sensory evaluations.
- **Laboratory Assessments**: Recording physiological data like body temperature, tidal volume, and total blood count using advanced instruments.

- **Group Work**: Collaborating in teams to perform physiological tests and analyze results.

Support and Feedback: The course instructor will provide guidance and feedback during lab sessions and will be available for additional support. Peer discussions and group collaborations will also offer opportunities for shared learning.

Textbooks

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee Brothers Medical Publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3. Physiological Basis of Medical Practice by Best and Tailor. Williams & Wilkins Co., Riverview, MI, USA.
4. Textbook of Medical Physiology by Arthur C. Guyton and John E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora and Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh. Jaypee Brothers Medical Publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai. Jaypee Brothers Medical Publishers, New Delhi.
8. Practical Workbook of Human Physiology by K. Srinageswari and Rajeev Sharma. Jaypee Brothers Medical Publishers, New Delhi.

Suggested Readings

1. Physiological Basis of Medical Practice by Best and Tailor. Williams & Wilkins Co., Riverview, MI, USA.
2. Textbook of Medical Physiology by Arthur C. Guyton and John E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (Vol. 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers, Kolkata.

Open Educational Resources (OER)

1. **https://jru.edu.in/studentcorner/lab-manual/bpharm/2nd sem/Lab% 20Manual%20-%20Human%20Anatomy%20and%20Physiology%20II.pdf**

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	5
2	Sessional Examination (Written Examination)	60Minutes	10
3	End Term Examination (Written Examination)	180 Minutes	35
Total			**50**

SEMESTER II					
BP208P	Pharmaceutical Organic Chemistry I – Practical	**L**	**T**	**P**	**C**
Version:	**2.0**	**0**		**4**	**2**
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	General Organic Chemistry				

Course Perspective: This course deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions. This course is designed to impart a fundamental knowledge of principle behind basic mechanism and orientation of organic reactions as well as qualitative analysis of functional groups. This course also emphasizes on practical knowledge on preparation and pharmaceutical application of various class of organic compounds.

Course Outcomes:

Upon completion of the course the learner will be able to:

CO 1: Understanding the organoleptic and physical properties of organic compounds

CO 2: Applying the fundamental principles of organic chemistry.

CO 3: Analyzing concepts of organic chemical structure, bonding and stability to predict and explain patterns in shape, structure, bonding, hybridization, formal charge, stability, acidity, basicity, solubility, and reactivity for hydrocarbons, alkenes, dienes, alkyl halides, alcohols, carbonyl compounds, carboxylic acids and amines.

CO 4: Evaluating concepts associated with fundamental organic reactions like substitution, elimination, addition, rearrangement, cycloaddition, ring-opening, and radical halogenation to product prediction, identification, synthesis design, and reaction mechanism.

CO 5: Creating laboratory–based practice and research that requires familiarity with the glassware and equipment used in synthesizing, extracting, separating, crystallising and analysing organic compounds**.**

Course Content

List of Experiments

A. Systematic qualitative analysis of unknown organic compounds like

1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
3. Solubility test
4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
5. Melting point/Boiling point of organic compounds
6. Identification of the unknown compound from the literature using melting point/ boiling point.

7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
8. Minimum 5 unknown organic compounds to be analysed systematically.

B. Preparation of suitable solid derivatives from organic compounds

C. Construction of molecular models

Learning Experience: This course will be conducted through a blend of lectures, hands-on laboratory sessions, and interactive group work to provide a comprehensive learning experience. Instructional methods will include detailed lectures on classification of organic compounds, identification and concept of organic reaction mechanism reinforced by multimedia presentations and virtual lab simulations to illustrate complex concepts. Group activities, including case studies and collaborative problem-solving exercises, will enhance peer learning and teamwork skills. Assignments will involve real-world applications, challenging students to devised logical and detailed mechanisms and draw meaningful conclusions.

To support learning, regular feedback through will be provided through assessments, quizzes, and one-on-one consultations. The course in charge will be available for additional guidance, encouraging students to seek help when needed. Collaborative learning will be emphasized, with opportunities for students to work together, exchange ideas, and conduct peer reviews, ensuring a participatory and engaging educational experience.

Text Books

1. Organic Chemistry by Morrison and Boyd
2. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.

Reference Books/Materials

1. Organic Chemistry by I.L. Finar , Volume-I
2. Vogel’s text book of Practical Organic Chemistry
3. Advanced Practical organic chemistry by N.K.Vishnoi.
4. Practical Organic Chemistry by Mann and Saunders

Open Educational Resources (OER)

1. Swayam course: Introductory Organic Chemistry I by Prof. Neeraja Dashaputre and Prof. Harinath Chakrapani
2. Swayam course: Introductory Organic Chemistry II by Prof. Neeraja Dashaputre and Prof. Harinath Chakrapani
3. Swayam course: Basic Organic Chemistry by Prof. Tharmalingam Punniyamurthy

Evaluation Scheme:

S. No.	Evaluation Component	Duration	Weightage (%)
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		10
2	Sessional I/II Examination (Written Examination)	1 h	15
3	End Term Examination (Written Examination)	3 h	75
Total			**100**

SEMESTER II					
BP209P	Biochemistry – Practical	**L**	**T**	**P**	**C**
Version:	**2.0**	**0**		**4**	**2**
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Chemistry				

Course perspective

Biochemistry practical course focuses on hands-on experimentation with key biochemical techniques, including protein analysis, nucleic acid methods, and enzyme assays. Students develop skills in chromatography and spectrophotometry while exploring metabolic pathways.

Course outcomes

Upon completion of the course the learner will be able to:

CO 1: Understanding the biochemistry of physiological process

CO 2: Applying the principles of biochemistry in estimation

CO 3: Analyzing of biochemistry in estimation findings with test samples

CO 4: Evaluating biochemistry results with findings

CO 5: Creating laboratory–based practice and research that requires familiarity with the equipment used in synthesizing, extracting, separating biochemicals

Course content 4 Hours / Week

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.

12. Study the effect of substrate concentration on salivary amylase activity.

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Practical Record/Viva)	-	5	
2	Sessional Examination (Written Examination)	3 hr	10	
3	End Term Examination (Written Examination)	3 hr	35	
Total			**50**	

SEMESTER II					
BP210P	**Computer Applications in Pharmacy – Practical***	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**0**	**2**	**1**
Category of Course	Core				
Total Contact Hours	30				
Pre-Requisites/ Co-Requisites	Mathematics				

Course perspective:

"Computer Applications in Pharmacy" course typically covers the integration of technology and computer systems in the pharmaceutical industry.

Course outcomes

CO 1: Understanding the basic concepts of biostatistics.

CO 2: Applying the different software into the database

CO3: Analyzing the outcome of database and their impacts

Course content

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page 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 database 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 web pages

12. Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

1. Computer Application in Pharmacy– William E.Fassett–Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.

2. Computer Application in Pharmaceutical Research and Development–Sean EkinsWiley-Interscience, A John Willey and Sons, INC., Publication, USA

3. Bioinformatics (Concept, Skills and Applications)– S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi– 110 002(INDIA)

4. Microsoft office Access- 2003, Application Development Using VBA, SQL Server, DAPand Infopath– CaryN.Prague– Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi- 110002

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		5	

2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		35	

SEMESTER I					
BP301T	**Pharmaceutical organic chemistry-II**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**-**	**4**
Category of Course	Core Course				
Total Contact Hours	45 hours				
Pre-Requisites/ Co-Requisites					

Course Perspective

Pharmaceutical Organic Chemistry is designed to understand chemical principles underlying drug development and synthesis. This course builds on foundational organic chemistry knowledge, focusing on the structure, reactivity, and mechanisms of organic compounds relevant to pharmaceuticals.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the structure, nomenclature, and basic properties of various classes of organic compounds relevant to pharmaceuticals.

CO 2: Applying the reaction mechanisms and functional group transformations in organic chemistry related to drug synthesis and modification.

CO 3: Applying the role of functional groups in determining the pharmacological activity and solubility of organic drug molecules.

CO 4: Evaluating organic reaction mechanisms to solve problems in the synthesis and design of pharmaceutical compounds.

CO 5: Creating organic reaction mechanisms to identify key intermediates and rate-determining steps in drug synthesis processes.

Course Content

UNIT I **10 Hours**

Benzene and its derivatives

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B. Reactions of benzene - nitration, sulphonation, halogenation reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II **10 Hours**

A. Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

B. Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

C. Aromatic Acids* –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III **10 Hours**

Fats and Oils

a. Fatty acids – reactions.

b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV **08 Hours**

Polynuclear hydrocarbons:

a. Synthesis, reactions
b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivative

UNIT V **07 Hours**

Cyclo alkanes*

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 only

Learning outcomes

5. Students will be able to recall the structure, nomenclature, and properties of organic compounds relevant to pharmaceuticals.
6. Students will learn to explain various reaction mechanisms and functional group transformations in drug synthesis.
7. Students will be able to describe the principles behind various organic reactions used in drug development.

8. Students will get knowledge to analyse the stereochemistry of organic molecules and predict the outcomes of stereochemical changes in drug compounds.

Textbooks

1. Organic Chemistry by Morrison and Boyd
2. Textbook of Organic Chemistry by B.S. Bahl & Arun B
3. Paula yurkanis bruice – organic chemistry 4th edition
4. Organic Chemistry by P.L Soni

Open Educational Resources (OER)

1.https://gyansanchay.csjmu.ac.in/pharmaceutical-chemistry/

2.https://www.lastbenchpharmacist.in/post/b-pharm-b-pharm-pharmaceutical-organic-chemistry-3-pdf-notes

3.https://www.udemy.com/course/a-complete-guide-to-pharmaceutical-organic-chemistry-ii/?couponCode=SKILLS4SALEB

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	

Total	100	

SEMESTER III					
BP302 T	**Physical Pharmaceutics I – Theory**	**L**	**T**	**P**	**C**
Version	2.0	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pharmaceutics and Pharm Organic Chemistry				

Course Perspective.

Physical Pharmaceutics covers the essential physical and physicochemical properties that influence dosage form development. Through both theory and practical components, students gain insights into formulation research, development, and stability studies. This foundational course connects basic sciences

with applied pharmaceutics, equipping students with the knowledge to design and optimize safe, effective, and stable pharmaceutical formulations. It is crucial for anyone pursuing a career in pharmacy or pharmaceutical sciences, as it underpins understanding of drug behaviour, formulation, and delivery.

Upon the completion of the course student shall be able to

CO1: Understanding the fundamental physical and physicochemical properties that impact the formulation of pharmaceutical dosage forms.

CO2: Applying fundamental techniques to conduct stability studies and assess the impact of environmental factors on the stability of various pharmaceutical formulations.

CO3: Analysing the relationship between the physicochemical properties of ingredients and their roles in the effectiveness and stability of dosage forms.

CO4: Evaluating different formulation strategies and recommend suitable methods for enhancing the stability and efficacy of pharmaceutical products.

Course Content

SYLLABUS

UNIT-I **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions,ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications.

UNIT-II **10 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid- crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation,dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation,

UNIT-IV **08Hours**

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action,
crystalline structures of complexes and thermodynamic treatment of stability constants.

UNIT-V **07 Hours**

pH, buffers and Isotonic solutions**:** Sorensen's pH scale, pH determination

(electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical & biological systems, buffered isotonic solutions.

Learning Experience

The course offers an engaging learning experience through a combination of interactive lectures, hands-on lab sessions, and problem-based learning (PBL). Students apply theoretical concepts in practical settings, gaining experience with techniques like solubility determination and surface tension measurement. Modern technology, such as simulation tools, helps visualize complex ideas, while guest lectures from industry professionals provide real-world insights. Continuous assessment and feedback ensure students master the material, preparing them for successful careers in the pharmaceutical industry.

Textbooks

1. Physical Pharmaceutics by C.V.S. Subramanyam

2. Text book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

Suggested Readings

1. Physical Pharmacy by Alfred Martin

Open Educational Resources (OER)

1. https://www.slideshare.net/jayrakti/solubility-of-drugs-237277502
2. https://www.slideshare.net/KhalifaAsif/states-of-matter-and-its-properties
3. https://www.slideshare.net/SumitMittal18/physicochemical-properties-of-drug-248441303

4. https://www.slideshare.net/RahulPals/surface-and-interfacial-phenomenon
5. https://www.slideshare.net/MahewashPathan/complexation-and-protein-binding-238974377

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

SEMESTER III					
BP303 T	**Pharmaceutical Microbiology (Theory)**	**L**	**T**	**P**	**C**
Version	**2**	**3**	**1**	**-**	**4**
Category of Course	Core Course				
Total Contact Hours	45 Hours				
Pre-Requisites/Co-Requisites					

Course Perspective:

Pharmaceutical Microbiology explores the role of microorganisms in the development, production, and safety of pharmaceutical products. The course covers microbial identification, cultivation, and preservation techniques, emphasizing their application in contamination control, sterilization, and aseptic processes. Students will learn about microbial assays, spoilage prevention, and sterility testing to ensure product safety and efficacy. The curriculum also addresses microbiological standardization and quality control in pharmaceuticals. This knowledge is essential for ensuring the safety and effectiveness of medicines and healthcare products.

Course Outcomes

Upon completion of this course the student should be able to

1. Understanding different methods of identification, cultivation, and preservation of various microorganisms.
2. Applying the knowledge of microbial growth for effective contamination control
3. Analyzing sterility testing of pharmaceutical products.
4. Evaluating microbiological standardization of Pharmaceuticals.

Course Content

UNIT I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

UNIT II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization.

UNIT III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

UNIT IV **08 hours** Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

UNIT V **07 hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

Learning Experience:

This subject provides a strong foundation in microbiology's role in the pharmaceutical industry. The detailed exploration of bacteria, fungi, and viruses, along with their morphology, growth, and identification techniques, was insightful. Practical skills in staining, microscopy, and sterilization methods are particularly valuable. Learning about aseptic area design, microbial contamination, and spoilage highlighted the importance of product safety. Additionally, understanding microbiological assays, antibiotic standardization, and cell culture applications offered key insights into real-world pharmaceutical processes, ensuring both microbial stability and product efficacy.

Text Books

1. A Textbook of Pharmaceutical Microbiology, Dr. Rohit Shankar Mane
2. A Textbook of Pharmaceutical Microbiology, Prahlad Singh Mehra.
3. A Text Book of Pharmaceutical Microbiology, Prof. Chandrakant Kokare

Reference Books/Materials

1. Pharmaceutical Microbiology, Tim Sandle

2. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.

3. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.

4. Rose: Industrial Microbiology.

Open Educational Resources (OER)

1. https://shop.elsevier.com/books/pharmaceutical-microbiology/sandle/978-0-08-100022-9

2.https://www.slideshare.net/slideshow/evaluation-of-the-efficiency-of-sterilization-methodssterility-indicators/254822477

Examination Scheme:

	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Attendance/ Presentation/ Extempore)	-	10	
2	Sessional Examination (Written Examination)	60 Minutes	15	
3	End Term Examination (Written Examination)	180 Minutes	75	

Total	**100**	

SEMESTER III					
BP 304 T	Pharmaceutical Engineering	**L** **4**	**T** **1**	**P** **4**	**C** **0**
Version	2.0				
Category of Course	Core course				
Total Contact Hours	45 Hours				
Pre-Requisites/Co-Requisites	Pharmaceutics				

Course Perspective

Pharmaceutical engineering deals with chemical engineering, biochemistry, and pharmacology to develop and manufacture drugs. Career opportunities span pharmaceutical manufacturing, quality control, regulatory affairs, and R&D. Graduates can pursue advanced studies in drug delivery,

biopharmaceuticals, or regulatory science. Emerging trends include personalized medicine, sustainable manufacturing, and AI in drug development, making this field essential for advancing healthcare and pharmaceutical innovation.

Course Outcome:

CO1: Understanding **t**he working principles of machinery used in pharmaceutical manufacturing, such as tablet compression machines, reactors, and centrifuges.

CO 2: Applying mathematical models to solve problems related to pharmaceutical processes like distillation, evaporation, and extraction.

CO 3: Analyzing the process flow diagrams of pharmaceutical manufacturing plants for better understanding of operations.

CO 4: Evaluating the efficiency and effectiveness of different pharmaceutical equipment and processes used in industry.

Course Content

Unit No: 01 **No. of Hours -** 10

- **The flow of fluids:** s of manometers, Reynolds number and its significance,

  Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitot tube and Rotameter.

- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

Unit No: 02 No. of Hours - 10

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law,

  Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

- **Evaporation:** Objectives, applications and factors influencing evaporation,

  differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube
  evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

- **Distillation**: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

Unit No: 03 **No. of Hours - 08**

- **Drying**: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray
  dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

- **Mixing**: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.

Unit No: 04 **No. of Hours - 08**

- **Filtration**: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter &Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation**: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non- perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Unit No: 05 **No. of Hours - 07**

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 there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling

Learning Experience

- **Laboratory Work**: Hands-on experience in labs, where you might work on drug formulation, quality control, and manufacturing processes.

- **Industry Experience**: Internships or co-op programs in pharmaceutical companies, providing real-world experience in drug development, production, and quality assurance.

- **Regulatory Knowledge**: Understanding the regulatory environment and compliance requirements for drug approval and manufacturing.

Textbooks

- Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
- Unit operation of chemical engineering – Mcabe Smith, Latest edition.
- Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition
- Theory and practice of industrial pharmacy by Lachmann., Latest edition.
- Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Suggested Readings

- Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
- Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition

Open Educational Resources (OER)

1. **https://www.sciencedirect.com/topics/nursing-and-health- professions/pharmaceutical-engineering**

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation Component	Duration	Weightage (%)	Date
1	Sessional Examination (Written Examination)	1.5 Hour	20	
2	End Term Examination (Written Examination)	03 Hour	80	
Total			**100**	

SEMESTER I					
BP 305P	**Pharmaceutical organic chemistry-II (practical)**	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**-**	**4**	**2**
Category of Course	Core Course				
Total Contact Hours	45 hours				
Pre-Requisites/ Co-Requisites	S				

Course Perspective: Pharmaceutical organic chemistry focuses on the study and development of organic compounds used as medications and drugs. It involves the synthesis, structure, and reactivity of organic molecules, with an emphasis on those compounds that have medicinal properties. Pharmaceutical

organic chemistry practical involves hands-on laboratory work and experiments that focus on the synthesis, purification, characterization, and analysis of organic compounds with potential pharmaceutical applications.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding of Organic Chemistry Principles including extraction processes, titrations, acid-base chemistry, stereochemistry, and functional group chemistry.

CO 2: Understanding proper laboratory safety procedures and protocols, including the use of personal protective equipment (PPE) and understanding chemical safety data sheets (SDS).

CO 3: Applying organic chemistry principles to pharmaceuticals such as chromatography, distillation, crystallization, and extraction, and demonstrate safe laboratory practices

CO 4: Analysing reaction mechanisms and statistical data to predict the purity of the compound and outcomes for synthetic procedures.
CO 5: Evaluation of various experimental procedures and outcomes, making informed decisions based on data analysis

Course content

I. Experiments involving laboratory techniques

· Recrystallization

· Steam distillation

II. Determination of the following oil values (including standardization of reagents)

· Acid value

· Saponification value

· Iodine value

III. Preparation of compounds

· Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction.

· 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/

· Acetanilide byhalogenation (Bromination) reaction.

· 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene by nitration reaction.

· Benzoic acid from Benzyl chloride byoxidation reaction.

· Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.

· 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.

· Benzil from Benzoin byoxidation reaction.

· Dibenzal acetone from Benzaldehyde byClaison Schmidt reaction

· Cinnammic acid from Benzaldehyde byPerkin reaction

· P-Iodo benzoic acid from P-amino benzoic acid

Learning outcomes

9. Students will be able to synthesize and purify organic compounds using standard laboratory methods
10. Students will prepare and handle reagents and solutions, maintaining precision in measurements and experimental setups.

11. Students will be familiar about laboratory techniques such as distillation, extraction, chromatography, recrystallization, and melting point determination
12. Students will analyse reaction mechanisms and predict the outcomes of synthetic procedures

Textbooks

1.Practical Organic Chemistry by Mann and Saunders.

2.Vogel's textbook of Practical Organic Chemistry

3.Advanced Practical organic chemistry by N.K.Vishnoi.

4.Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz

Open Educational Resources (OER)

1.https://cuils.cuchd.in/cgi-bin/koha/opac-detail.pl?biblionumber=141756

2.https://jru.edu.in/studentcorner/lab-manual/bpharm/3rd-sem/Lab%20Manual%20of%20Organic%20Chemistry%20II.pdf

3.https://www.scribd.com/document/586659026/Practical-Lab-Manual-of-Pharmaceutical-Organic-Chemistry-2-1

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**

1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	4 hr.	35	
Total			50	

Semester III					
BP 306 P	**PHYSICAL PHARMACEUTICS-I (Practical)**	L	T	P	C
Version	2.0	0	0	4	2
Category of course	Core				
Total Contact	60 hours				

Hours	
Pre-Requisites/ Co-Requisites	Pharmaceutics-I / Physical Pharmaceutics-I Theory

Course Perspective:

Physical pharmaceutics, deals with application of physics and chemistry to the study of pharmacy. It focuses on the relationship between a drug's physical, chemical, and biological properties and its fate in vivo. Physical pharmaceutics is a critical discipline for drug and drug product design

Course Outcomes

Upon successful completion of this course, the students will be able to

CO1: Understanding the significance of physical properties such as solubility, surface tension, partition coefficient and pKa in the design of dosage forms.

CO2: Applying adsorption isotherms and determine Freundlich-Langmuir constant using activated charcoal

CO3: Analysing Henderson – Hasselbalch equation for interpretation of pKa value of drugs

CO4: Evaluating the surface tension , HLB value and critical micellar concentration of a surfactant.

Course Content **No. of Hours: 44 hours**

S. No.	Title of Experiment
1.	To Determine the solubility of drug at room temperature
2.	Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3.	Determination of Partition co- efficient of benzoic acid in benzene and water

4.	Determination of Partition co- efficient of Iodine in CCl4 and water
5.	Determination of % composition of NaCl in a solution using phenol-water system by CST method
6.	Determination of surface tension of given liquids by drop count method & drop weight method
7.	Determination of HLB number of a surfactant by saponification method
8.	Determination of Freundlich and Langmuir constants using activated char coal
9.	Determination of critical micellar concentration of surfactants
10.	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11.	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method.

Text Books

1. Experimental Pharmaceutics by Eugene, Parott.

2. Tutorial Pharmacy by Cooper and Gunn.

3. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3,

Marcel Dekkar Inc.

4. Physical Pharmaceutics by Ramasamy C and Manavalan R.

5. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

6. Physical Pharmaceutics by C.V.S. Subramanyam

Suggested Reading

1. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
2. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.

Open Educational Resources (OER):

1. **Videos:** **https://www.youtube.com/watch?v=3uQoyHbBzuw**

   https://www.youtube.com/watch?v=JjMHbN3BdBs

   https://www.youtube.com/watch?v=cUQjnfw2FJw

Evaluation Scheme:

	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		20	

2	Sessional I/II Examination (Practical Examination)	240 Minutes	10	
3	End Term Examination (Practical Examination)	240 Minutes	70	
Total			**100**	

SEMESTER III					
BP307P	**Pharmaceutical Microbiology**	**L**	**T**	**P**	**C**

Version	2.0	**0**	**0**	**4**	**2**
Category of Course	Core Subject				
Total Contact Hours	45				
Pre-Requisites/ Co-Requisites	Human Anatomy and Physiology				

Course Perspective Microbiology in pharmacy integrates the study of microorganisms with pharmaceutical sciences, focusing on how microbes impact drug development, manufacturing, and public health. Core subjects include general microbiology, pharmaceutical microbiology, immunology, virology, and microbial genetics. Students learn about microbial contamination, sterilization techniques, and the role of microbes in drug safety and efficacy. Specialized electives may include industrial microbiology, antimicrobial resistance, and probiotics.

The curriculum offers practical exposure through lab work, helping students understand microbial testing, quality control, and infection prevention in pharmaceutical settings. Graduates find career opportunities in pharmaceutical manufacturing, quality assurance, regulatory affairs, and clinical microbiology.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding various microbiological techniques used in pharmaceutical settings, including sterilization, disinfection, and microbial culture methods.

CO2: Appling aseptic techniques and microbial handling skills in the laboratory to ensure contamination-free environments in pharmaceutical processes.

CO3: Analysing microbial assays and tests, such as antibiotic potency tests, to assess the efficacy of pharmaceutical products.

CO4: Evaluating and carry out microbial quality control tests, such as environmental monitoring and preservative efficacy testing, ensuring safety in drug manufacturing.

CO5: Creating the techniques of microbial control in pharmaceutical production and its role in maintaining product safety and quality, aligning with industry standards.

Course Content

- Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
- Sterilization of glassware, preparation and sterilization of media.
- Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
- Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
- Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
- Microbiological assay of antibiotics by cup plate method and other methods
- Motility determination by Hanging drop method.
- Sterility testing of pharmaceuticals.
- Bacteriological analysis of water
- Biochemical test.

Learning Experience

1. **Laboratory Work:** Hands-on experience in labs, where you might work on drug formulation, quality control, and manufacturing processes.
2. **Industry Experience:** Internships or co-op programs in pharmaceutical companies, providing real-world experience in drug development, production, and quality assurance.
3. **Regulatory Knowledge:** Understanding the regulatory environment and compliance requirements for drug approval and manufacturing

Textbooks

1. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
2. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.

Suggested Readings

1.W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific

publications, Oxford London

Open Educational Resources (OER)

1. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7158362/**

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date

1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		20	
2	Sessional I/II Examination (Practical Examination)	240 Minutes	10	
3	End Term Examination (Practical Examination)	240 Minutes	70	
Total			**100**	

SEMESTER III					
BP308P	**Pharmaceutical Engineering**	**L**	**T**	**P**	**C**
Version	2.0	**0**	**0**	**4**	**2**

Category of Course	Core Subject
Total Contact Hours	45
Pre-Requisites/ Co-Requisites	Pharmaceutics

Course Perspective Pharmaceutical engineering combines chemical engineering, biochemistry, and pharmacology to develop and manufacture drugs. Career opportunities span pharmaceutical manufacturing, quality control, regulatory affairs, and R&D. Graduates can pursue advanced studies in drug delivery, biopharmaceuticals, or regulatory science. Emerging trends include personalized medicine, sustainable manufacturing, and AI in drug development, making this field essential for advancing healthcare and pharmaceutical innovation.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the working principles of machinery used in pharmaceutical manufacturing, such as tablet compression machines, reactors, and centrifuges.

CO 2: Applying mathematical models to solve problems related to pharmaceutical processes like distillation, evaporation, and extraction.

CO 3: Analyzing the process flow diagrams of pharmaceutical manufacturing plants for better understanding of operations.

CO 4: Evaluating the efficiency and effectiveness of different pharmaceutical equipment and processes used in industry

Course Content

- Determination of radiation is constant of brass, iron, unpainted, and painted glass**.**
- Steam distillation – To calculate the efficiency of steam distillation.
- To determine the overall heat transfer coefficient by heat exchanger.

- Construction of drying curves (for calcium carbonate and starch).
- Determination of moisture content and loss on drying.
- Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
- Description of Construction work and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, and dehumidifier.
- Size analysis by sieving – To evaluate the size distribution of tablet granulations –Construction of various size frequency curves including arithmetic and logarithmic probability plots.
- Size reduction: To verify the laws of size reduction using a ball mill and determine Kicks, Rittinger's, Bond's coefficients, power requirement, and critical speed of the Ball Mill.
- Factors affecting the Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ Viscosity
- To study the effect of time on the Rate of Crystallization.
- To calculate the uniformity Index for a given sample by using double-cone Blender.

Learning Experience

1. **Laboratory Work:** Hands-on experience in labs, where you might work on drug formulation, quality control, and manufacturing processes.
2. **Industry Experience:** Internships or co-op programs in pharmaceutical companies, providing real-world experience in drug development, production, and quality assurance.
3. **Regulatory Knowledge:** Understanding the regulatory environment and compliance requirements for drug approval and manufacturing

Textbooks

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
3. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition
4. Theory and practice of industrial pharmacy by Lachmann., Latest edition.

5. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Suggested Readings

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition

Open Educational Resources (OER)

1. **https://www.sciencedirect.com/topics/nursing-and-health-professions/pharmaceutical-engineering**

Evaluation Scheme:

	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		20	
2	Sessional I/II Examination (Practical Examination)	240 Minutes	10	
3	End Term Examination (Practical Examination)	240 Minutes	70	
Total			**100**	

BP401T	**PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Version	**2.0**
Pre-requisites/Exposure	**Chemistry of drugs**
Co-requisites	**Organic Chemistry**

Course perspective: Pharmaceutical Organic Chemistry –III - This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. This course will develop a mechanistic understanding of organic reactions such as substitution, addition, elimination, and rearrangement reactions.

COURSE OUTCOMES (COs)

Understanding the various organic compounds based on their functional groups and structural characteristics.

2. Applying the mechanisms of organic reactions, including electrophilic, nucleophilic, and free radical substitutions and additions.
3. Analyzing organic reactions to predict the products and outcomes of reactions involving pharmaceuticals.
4. Evaluating the stereochemistry of organic compounds and evaluating the effect of chirality on the biological activity of pharmaceuticals.

SYLLABUS

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

UNIT-I **10 Hours**

Stereo isomerism

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules

Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II **10 Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)

Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **08 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **7 Hours**

Reactions of synthetic importance

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Learning outcomes

1. Students will recall the mechanisms of organic reactions such as substitution, elimination, addition, and rearrangement reactions.
2. Students will learn to explain various reaction mechanisms and functional group transformations in drug synthesis.

3. Students will describe the principles behind various organic reactions for the synthesis and reactions of important heterocyclic compounds such as pyrrole, pyridine, and quinoline.
4. Students will get knowledge to analyse the stereochemistry of organic molecules and predict the outcomes of stereochemical changes in drug compounds.

Textbooks

1.Organic chemistry by I.L. Finar, Volume-I & II.

2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.

3. Heterocyclic Chemistry by Raj K. Bansal

4. Organic Chemistry by Morrison and Boyd

Reference Books/Materials

1. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.

2. Organic Chemistry by P.L.Soni

3. Reaction and reaction mechanism by Ahluwaliah/Chatwal

4. Heterocyclic Chemistry by T.L. Gilchrist

Open Educational Resources (OER)

1. https://www.carewellpharma.in/bpharmacy/notes/4th-sem/pharmaceutical-organic-chemistry-3/unit-4
2. https://www.researchgate.net/publication/377962321_Kinetic_and_Thermodynamic_Evidence_of_the_Paal-Knorr_and_Debus-Radziszewski_Reactions_Underlying_Formation_of_Pyrroles_and_Imidazoles_in_Hydrothermal_Liquefaction_of_Glucose-Glycine_Mixtures
3. https://www.sciencedirect.com/topics/chemistry/robinson-gabriel-synthesis
4. https://unacademy.com/content/neet-ug/study-material/chemistry/diels-alder-reaction-mechanism/

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination

Evaluation Scheme:				
-	**Evaluation Component**	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			100	

SEMESTER-IV					
BP 402 T	Medicinal Chemistry- I	**L**	**T**	**P**	**C**
Version	2.0	**3**	**1**	**-**	**4**
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Medicinal Chemistry and Pharmacology				

Course Perspective

The course perspective of Medicinal Chemistry focusses on making students learn the basic structure of a drug , its nomenclature , SAR , classification , Mechanism of Action , adverse effect , uses and its synthesis .

Course Outcomes

Upon completion of the course the learner will be able to:

CO1 Understanding the chemistry of drugs with respect to their pharmacological activity.

CO2 Applying drug metabolic pathways, adverse effect, and therapeutic value of drugs

CO3 Analysing the structural activity relationship of different class of drugs.

CO4 Evaluating synthesis of drugs.

Course Content

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- I **10 Lectures**

Introduction to Medicinal Chemistry

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

UNIT- II **10 Lectures**

Drugs acting on Autonomic Nervous System: Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.

Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 Lectures**

Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. Parasympathomimetic agents: SAR of Parasympathomimetic agents Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV **8 Lectures**

Drugs acting on Central Nervous System

Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous: Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

Antipsychotics: Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital. Hydantoins:

Phenytoin*, Mephenytoin, Ethotoin Oxazolidine diones:

Trimethadione, Paramethadione Succinimides:

Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **7 Lectures**

Drugs acting on Central Nervous System General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Learning Experience

The learning experience of medicinal chemistry offers students a comprehensive understanding of structures of drug , SAR , classification , MOA , uses , adverse effect and its synthesis .

Textbooks

1. Harkishan Singh and Kapoor, Medicinal Chemistry.
2. Wilson and Giswold’s Organic medicinal and Pharmaceutical Chemistry.
3. Foye’s Principles of Medicinal Chemistry.

Reference Books/Materials

1. Burger's Medicinal Chemistry, Vol I to IV.
2. Introduction to principles of drug design- Smith and Williams.
3. Remington's Pharmaceutical Sciences.
4. Martindale's extra pharmacopoeia.
5. Organic Chemistry by I.L. Finar, Vol. II.
6. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
7. Indian Pharmacopoeia.
8. Text book of practical organic chemistry- A.I.Vogel.

Online Reference

1. http://www.jiwaji.edu/pdf/ecourse/pharmaceutical/unit%20I%20med%20chem.pdf
2. https://www.slideshare.net/jaymaa/physicochemical-properties-of-drug
3. https://en.wikipedia.org/wiki/Drug_metabolism
4. https://www.intechopen.com/chapters/29241
5. https://www.slideshare.net/sajanmaharjan79/metabolism-32061230
6. https://jcpjaipur.com/wp-content/uploads/2020/05/Medicinal-Chemistry-Unit-II.pdf
7. https://www.uky.edu/~mtp/OBI836AR.html
8. https://www.mlsu.ac.in/econtents/895_Drugs%20acting%20on%20Autonomic%20Nervous%20System-I_pdf.pdf
9. https://www.ncbi.nlm.nih.gov/books/NBK556066/
10. https://nba.uth.tmc.edu/neuroscience/m/s1/chapter11.html
11. http://diposit.ub.edu/dspace/bitstream/2445/122796/1/TFG%20Elisabet%20Batlle%20%281%29.pdf

12. https://www.slideshare.net/hussain_761/barbiturates-16094504
13. https://www.slideshare.net/SagarJoshi2/antipsychotics-33785528
14. https://www.researchgate.net/publication/331594577_Drugs_acting_on_the_Central_Nervous_System_CNS
15. https://www.slideshare.net/FarazaJaved/narcotics-and-non-narcotics-analgesics
16. https://www.slideshare.net/FaranAli11/faran-ali-tariq-medicinal

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	**Duration**	**Weightage (%)**	**Date**
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		10	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		75	
	Total		100	

SEMESTER IV

BP403T	Physical pharmaceutics-II Theory	L	T	P	C
Version	2.0	3	1	0	4
Category of Course	Core				
Total Contact Hours	45 Hours				
Pre-Requisites/Co-Requisites	Pharmaceutics/ Physical Pharmaceutics				

Course Perspective

The Physical Pharmacy course is essential for understanding the scientific principles behind drug formulation and stability, crucial for both academic mastery and professional success in pharmaceutical development. Students will acquire skills in formulating and optimizing pharmaceutical products, ensuring their safety, efficacy, and quality in real-world applications such as drug delivery systems and stability testing.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding physicochemical properties of drug molecules in formulation research and development.

CO 2: Applying the relationship of various physicochemical properties of drug and excipient molecules in designing the dosage forms.

CO 3: Analysing chemical kinetics and stability testing parameters and formula expiration date estimation.

CO 4: Evaluating the pharmaceutical product performance through various characterization methods, ensuring the safety, efficacy, and quality of final products.

Course Content

UNIT-I **07 Hours**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

UNIT-II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV **10Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

Learning Experience

The Physical Pharmaceutics II course is designed to be highly experiential and participatory, ensuring that students not only understand theoretical concepts but also apply them in real-world scenarios. The course will be conducted using a blend of instructional methods, hands-on activities, and collaborative work to create a dynamic and engaging learning environment.

Methods of Instruction:

- **Lectures and Interactive Sessions:** Traditional lectures will be complemented with interactive discussions to deepen understanding. Students will be encouraged to ask questions and participate in problem-solving during class.
- **Case Studies:** Real-world case studies will be incorporated to connect theoretical knowledge with practical applications, allowing students to analyze and propose solutions to common industry challenges.

- **Technology Integration:** Advanced software tools and simulation programs will be used to demonstrate concepts like rheology and drug stability, providing students with the opportunity to visualize and manipulate data.

Experiential and Participatory Activities:

- **Hands-On Learning:** Students will engage in laboratory sessions where they can apply concepts such as colloidal dispersion, micromeretics, and rheological analysis. These practical experiences will solidify their understanding and enable them to perform critical tasks like particle size determination and viscosity measurement.
- **Group Work:** Collaborative group projects will be a key component of the course, allowing students to work together on tasks such as formulating suspensions or emulsions. This fosters teamwork and peer learning, as students share insights and challenge each other's understanding.
- **Assignments:** Regular assignments will include problem-solving exercises, formulation tasks, and critical analysis of drug stability. These will help students practice applying their knowledge to new situations, preparing them for real-world challenges.
- **Classroom and Outside Classroom Experiences:** In addition to classroom-based learning, students will have opportunities to engage in industry visits or virtual tours of pharmaceutical manufacturing facilities. These experiences will provide context and exposure to industry practices.

Assessment:

- **Continuous Assessment:** The course will include regular quizzes, mid-term exams, and lab reports to monitor student progress. These assessments will focus on both theoretical understanding and practical application.
- **Final Project:** A capstone project will require students to design and test a pharmaceutical formulation, applying all the knowledge and skills acquired throughout the course. This will be presented to the class and evaluated based on creativity, scientific rigor, and practical feasibility.

Support and Feedback:

- **Instructor Availability:** The course in charge will be readily available for additional support and feedback, offering office hours and one-on-one meetings to discuss any challenges students may face.

- **Peer Collaboration:** Students will be encouraged to collaborate and support each other through group activities and peer reviews. This peer interaction will enhance learning and provide multiple perspectives on problem-solving.
- **Regular Feedback:** Continuous feedback will be provided on assignments and projects, guiding students on how to improve and apply their knowledge effectively.

This comprehensive approach to teaching Physical Pharmaceutics II ensures that students are not only well-versed in theoretical concepts but also proficient in applying them in practical settings, preparing them for successful careers in the pharmaceutical industry.

Textbooks

1. Theory and Practice of Physical Pharmacy by Gaurav Kumar Jain, Farhan Jalees Ahmad, Roop Kishen Khar
2. Textbook of Physical Pharmaceutics by C.V.S. Subrahmanyam
3. Physical Pharmacy by Alfred Martin, Sixth edition

Suggested Readings

1. Tutorial pharmacy by Cooper and Gunn.
2. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
3. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
4. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, Marcel Dekkar Inc.
5. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Open Educational Resources (OER)

1. https://copharm.uobaghdad.edu.iq/wpcontent/uploads/sites/6/uploads/2017/lectuer/2nd%20stages/Physical%20pharmacy/Lectures%2031-36-Colloidal%20%20Dispersions-2.pdf
2. https://courseware.cutm.ac.in/wp-content/uploads/2021/03/session-2.pdf
3. https://www.toppr.com/guides/chemistry/surface-chemistry/classification-of-colloids/
4. https://pubmed.ncbi.nlm.nih.gov/2585243/
5. https://link.springer.com/referenceworkentry/10.1007/978-0-387-92897-5_143
6. https://www.thermopedia.com/content/1243/
7. https://www.rheosense.com/applications/viscosity/newtonian-non-newtonian
8. https://mycoscience.com/differences-between-capillary-and-rolling-ball-viscometers/
9. https://pediaa.com/difference-between-elastic-and-plastic-deformation/
10. https://www.scribd.com/document/475868137/HECKEL-EQUATION
11. https://www.philadelphia.edu.jo/academics/aadnan/uploads/Unit%205%20suspensions.
12. https://www.sciencedirect.com/topics/chemistry/stability-of-emulsion
13. https://issuu.com/theabhijitdn/docs/physical_pharmacy-_3rd_yr-_unit_1__
14. https://www.sciencedirect.com/science/article/pii/S2666833521000861
15. https://www.studocu.com/in/document/mewar-university/pharmaceutical-microbiology/micromeritics-unit2/39515476
16. https://www.acrobiosystems.com/A1794-MALS-UNcle-Platform.html?gclid=EAIaIQobChMI36yb1MCh_gIVgUcrCh39JgMREAAYASAAEgLO3vD_BwE
17. https://core.ac.uk/download/pdf/55765715.pdf
18. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/bulk-density
19. https://www.sips.org.in/wp-content/uploads/2020/03/KINETICS-AND-DRUG-STABILITY.pdf
20. https://www.pharmacy180.com/article/factors-affecting-reaction-kinetics-2735/
21. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/drug-stability

22. https://d1wqtxts1xzle7.cloudfront.net/89890386/xuebalib.com.13123-libre.pdf?1660843925=&response-content-disposition=inline%3B+filename%3DAccelerated_aging_prediction_of_chemical.pdf&Expires=1681209121&Signature=do3x1eYz~Pmm3BDsH-WrN1eMCMkRObAwSTn2NREw6Jfv-DzBJPx-IZMP6WoeLw5DURD~5SamhZD-FUADj3sblcvskKxTGRkRjmBK0zQtSCS4Ub3e~FcssxTFLP74eWK4--jvFOdsfeCKJZ18AY3Ig7D44vZi280yrlnc4S3caO~P4A1IxxLbbks4lVrC-gO8xJ3eRJJS-u1~a6OX3VULKNw3ds1YmKu41ROXNdaLAVADltD5AIaJkF0uvcZp5pDSeDw411nTvw-MY3T5tNSHPER0R1L81C3syoas6LJ1zuGkWsztsIXOdOO4PMPrVxDBIBpTNnNPrH63yprWmjGHhA__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA
23. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/photodegradation

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

SEMESTER IV					
BP 404 T	**Pharmacology I– Theory**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**

Category of Course	Core
Total Contact Hours	45 hrs
Pre-Requisites/ Co-Requisites	Human Anatomy & Physiology

Course Perspective

The Pharmacology-I course for B Pharmacy students is designed to provide foundational knowledge and practical skills in the pharmacology of drugs acting on the nervous system.

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding the organization and functions of the ANS, neurohumoral transmission, and classification of neurotransmitters**.**

CO2. Applying knowledge of CNS neurotransmitters to understand the mechanisms of action of general anesthetics, sedatives, anti-epileptics, and other CNS drugs.

CO3. Analyzing the effects and therapeutic uses of psychopharmacological agents and drugs for conditions like Parkinson's and Alzheimer's disease.

CO4. Evaluating the mechanisms of action of general anesthetics, sedatives, anti-epileptics, and other CNS drugs using the experiments

Course Content

UNIT-I (08 hours)

1. General Pharmacology

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II (12 Hours)

General Pharmacology

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT-III (10 Hours)

Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS. b. Neurohumoral transmission, co-transmission and classification of neurotransmitters. c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anesthetic agents. f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV (08 Hours)

Pharmacology of drugs acting on central nervous system.

a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anesthetics and pre-anesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram

UNIT-V (07 Hours)

Pharmacology of drugs acting on central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. b. Drugs used in Parkinsons disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.

Learning experience

In-Depth Study of Drug Mechanisms:

Students will analyze how drugs interact with the autonomic and central nervous systems, including their mechanisms of action and therapeutic effects. Practical labs will involve evaluating drug interactions and their clinical outcomes.

Interdisciplinary Approach:

The course integrates pharmacology with neuroscience and clinical medicine to understand how drugs impact neural pathways and treat neurological conditions. This approach links theoretical knowledge with practical applications across disciplines.

Industry Relevance:

Students will gain skills pertinent to pharmaceutical careers, including drug development and quality control, by learning about current practices in pharmacovigilance and regulatory affairs. The course prepares students for roles in ensuring drug safety and efficacy.

Clinical Applications:

Emphasis is placed on applying pharmacological knowledge in clinical settings, using case studies and simulated scenarios to inform treatment decisions. This prepares students for practical challenges in healthcare environments.

Ethical and Sustainable Practices:

The course explores ethical issues and sustainable practices in drug development, including drug addiction and dependence. Students will learn to balance therapeutic benefits with ethical and environmental considerations.

Textbooks

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

3. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Suggested Readings

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP503T_PGPC_UNIT_I.pdf
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester IV

BP405 T	**Pharmacognosy and Phytochemistry I– Theory**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Remedial Biology				

Course Perspective

Pharmacognosy and phytochemistry are disciplines that can greatly enhance a student's academic, career, and professional growth. Here's an overview of how these fields support each of these areas:

Course Outcomes

Upon completion of this course the student should be able to:

CO1. Understanding the techniques in the cultivation and production of crude drugs

CO2. Applying latest analytical and chromatographic techniques for analysis of crude drugs

CO3. Analyzing the various classes of secondary metabolites of medicinal importance

CO4. Evaluating the modern methods of extraction and isolation of crude drugs

SYLLABUS

Unit I 10 Hours

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture

(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilage, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero

taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical,

chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

Unit II 10 Hours

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

Factors influencing cultivation of medicinal plants. Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

Unit III 10 Hours

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements,

growth and their maintenance.

Applications of plant tissue culture in pharmacognosy. Edible vaccines

Unit IV 08 Hours

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda,

Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides,

Flavonoids, Tannins, Volatile oil and Resins

Unit V 07Hours

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

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 Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatine, casein, proteolytic enzymes (Papain, bromelain, serrati peptidase, urokinase, streptokinase, pepsin).

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

Marine Drugs:

Novel medicinal agents from marine sources

Learning Experience

The "Pharmacognosy & Phytochemistry II" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of natural products and their chemical properties.

In-Depth Study of Natural Products: The course covers advanced topics related to the chemistry of medicinal plants, including secondary metabolites, alkaloids, glycosides, and essential oils.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding of how natural products impact health and disease.

Industry Relevance: The course prepares students for careers in pharmaceuticals, herbal medicine, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Pharmacognosy & Phytochemistry II" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of natural products.

Textbooks

1.Pharmacognosy & Phytochemistry by Deore SL, Khadabadi SS, Baviskar BA

2.Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.

3. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.

Reference Books/Materials

1 W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

2. Textbook of Pharmacognosy by T.E. Wallis

Online Reference

1. https://www.carewellpharma.in/B_Pharmacy/Notes/4th_Sem/Pharmacognosy-I/Unit_4/

2. https://pharmshala.in/b-pharm-4th-semester-notes-in-pdf/

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester IV					
BP406P	**Medicinal chemistry – I (practical)-**	**L**	**T**	**P**	**C**
Version	**2.0**	**-**	**-**	**4**	**2**
Category of Course	Practical				
Total Contact Hours	4 Hrs per week				
Pre-Requisites/ Co-Requisites	**Synthesis, Reaction Mechanism**				

Course Perspective

This course focuses on the practical applications of medicinal chemistry concepts.

Course outcomes

Upon completion of this course the student should be able to

1. Understanding the chemistry of drugs with respect to their pharmacological activity
2. Applying the chemistry of drugs with respect to their pharmacological activity drugs to learn drug action
3. Analysing mechanism of reaction and Structural Activity Relationship (SAR) of different class of drugs
4. Evaluating methods and basics required for the assay of some drugs

SYLLABUS

UNIT-I

I Preparation of drugs/ intermediates

1 1,3-pyrazole
2 1,3-oxazole
3 Benzimidazole
4 Benztriazole
5 2,3- diphenyl quinoxaline
6 Benzocaine
7 Phenytoin
8 Phenothiazine
9 Barbiturate

UNIT-II

II Assay of drugs

1 Chlorpromazine
2 Phenobarbitone
3 Atropine
4 Ibuprofen

5 Aspirin

6 Furosemide

UNIT-III

Determination of Partition coefficient for any two drugs

Textbook

1. Text book of practical organic chemistry- A.I.Vogel.

Reference Books/Materials

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia

Online Reference (OER)

1. https://notes.pharmadhunia.com/assets/files/20180415203105984961_20180415090824467543O_b_pharm___lab_manual__medicinal_chemistry.pdf
2. http://www.sarajapharmacycollege.com/downloads/mc.pdf
3. https://labmonk.com/synthesis-of-23-diphenylquinoxaline

4. https://labmonk.com/synthesis-of-13-substituted-pyrazole-i-e-13-diphenyl-pyrazole-from-diarylhydrazone-i-e-diphenyl-hydrazone-and-vicinal-diol
5. https://labmonk.com/synthesis-of-benzotriazole#:~:text=Benzotriazole%20can%20be%20prepared%20by,cyclization%20reaction%20to%20produce%20benzotriazole.

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Practical Record/Viva)	-	05	
2	Sessional Examination (Written Examination)	240 Minutes	10	
3	End Term Examination (Written Examination)	240 Minutes	35	
Total			**50**	

Semester IV					
BP 407P	**PHYSICAL PHARMACEUTICS-II (Practical) - 60hrs**	L	T	P	C
Version	2	0	0	4	2
Category of course	Core				
Total Contact Hours	60 hours				
Pre-Requisites/ Co-Requisites	Pharmaceutics-I / Physical Pharmaceutics-II Theory				

Course Perspective:

Physical pharmaceutics, also known as physicochemical principles of pharmacy, is a branch of pharmacy that studies the application of physics and chemistry to the study of pharmacy. It focuses on the relationship between a drug's physical, chemical, and biological properties and its fate in vivo.

Course Outcomes

Upon successful completion of this course, the students will be able to

CO1 Understanding physicochemical properties of drug molecules

CO2 Applying the chemical stability tests of various drug products and determination of expiry date of formulations

CO3 Analysing physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content **No. of Hours: 44 hours**

S. No.	Title of Experiment
1.	To Determine and study particle size, particle size distribution using sieving method.
2.	To determine and study particle size, particle size distribution using Microscopic method
3.	Determination of bulk density, true density and porosity
4.	Determine the angle of repose and influence of lubricant on angle of repose
5.	Determination of viscosity of liquid using Ostwald's viscometer
6.	Determination sedimentation volume with effect of different suspending agent
7.	Determination sedimentation volume with effect of different concentration of single suspending agent
8.	Determination of viscosity of semisolid by using Brookfield viscometer
9.	Determination of reaction rate constant first order.
10.	Determination of reaction rate constant second order
11.	Accelerated stability studies

Text Books

1. Experimental Pharmaceutics by Eugene, Parott.

2. Tutorial Pharmacy by Cooper and Gunn.

3. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3,

Marcel Dekkar Inc.

4. Physical Pharmaceutics by Ramasamy C and Manavalan R.

5. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

6. Physical Pharmaceutics by C.V.S. Subramanyam

Suggested Reading

1. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
2. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.

Open Educational Resources (OER):

1. **Videos:** **https://www.youtube.com/watch?v=AM-NrQoRIYY**

https://www.youtube.com/watch?v=I3Gc5MvExOk

https://www.youtube.com/watch?v=ivGDS7Imtx0

https://www.youtube.com/watch?v=xg_xAxGNwnM

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		20	
2	Sessional I/II Examination (Practical Examination)	240 Minutes	10	
3	End Term Examination (Practical Examination)	240 Minutes	70	
Total			**100**	

Semester IV					
BP408P	Pharmacology –I	**L**	**T**	**P**	**C**
Version	**2.0**	**0**	**0**	**4**	**2**
Category of Course	Practical				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Human Anatomy and Physiology				

Course Perspective: A practical pharmacology course bridges theoretical concepts with hands-on experience, focusing on drug mechanisms, effects, and interactions. Students gain proficiency in laboratory techniques, data analysis, and experimental design. The course emphasizes critical thinking, real-world applications, and effective communication of findings.

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding the pharmacological actions of different categories of drugs

CO2. Applying the mechanism of drug action at organ system/sub cellular/ macromolecular levels.

CO3. analyzing the basic pharmacological knowledge in the prevention and treatment of various diseases.

CO4. Evaluating the effect of drugs on animals by simulated experiments

CO5. Creating correlation of pharmacology with other bio medical sciences

Course Content

1. Introduction to experimental pharmacology.

2. Commonly used instruments in experimental pharmacology.

3. Study of common laboratory animals.

4. Maintenance of laboratory animals as per CPCSEA guidelines.

5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.

6. Study of different routes of drugs administration in mice/rats.

7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.

8. Effect of drugs on ciliary motility of frog oesophagus

9. Effect of drugs on rabbit eye.

10. Effects of skeletal muscle relaxants using rota-rod apparatus.

11. Effect of drugs on locomotor activity using actophotometer.

12. Anticonvulsant effect of drugs by MES and PTZ method.

13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.

14. Study of anxiolytic activity of drugs using rats/mice. 15. Study of local anesthetics by different methods

Learning Experience

The practical pharmacology course offers hands-on experience in drug analysis, allowing students to directly observe and measure drug effects. It enhances skills in laboratory techniques, data interpretation, and critical evaluation. This practical approach solidifies theoretical knowledge through real-world applications and experimental work.

Textbooks

1. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

2. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher

3. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,

Reference book(s) :

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier

2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill

3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins

5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology

Open Educational Resources (OER)

1. https://www.aitbspublishersindia.com/medical/pharmacology/Pharmacological-Screening-Methods
2. https://www.slideshare.net/sanyalhari/pharmacological-screening-by-harikesh-maurya

https://www.slideshare.net/TanuJa4/screening-methods-in-pharmacology

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	5	
2	Sessional Examination (Written Examination)	60Minutes	10	
3	Attendance			
4	End Term Examination (Written Examination)	180 Minutes	35	
Total			**50**	

Semester IV					
BP 409 P	**Pharmacognosy and Phytochemistry I– Practical**	**L**	**T**	**P**	**C**
Version	**2.0**	**0**	**0**	**4**	**2**
Category of Course	Core				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Remedial Biology (Practical)				

Course Perspective. Pharmacognosy is the study of drugs derived from natural sources, primarily plants, but also including animals and minerals. A practical course in pharmacognosy typically involves hands-on activities that help students understand the identification, extraction, and analysis of these natural substances.

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding of the fundamental principles of pharmacognosy and their applications to pharmaceuticals

CO2. Appling their knowledge in identification, microscopy of crude drugs.

CO3. Analysing the concept by identification, cultivation and application of various herbs & Health food prescribing for various health issues.

CO4. Evaluating the crude drugs its chemical nature and their activities.

Course Content

1.Morphology, histology and powder characteristics & extraction & detection of:

Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander

2. Exercise involving isolation & detection of active principles

a. Caffeine - from tea dust.

b. Diosgenin from Dioscorea

c. Atropine from Belladonna

d. Sennosides from Senna

3. Separation of sugars by Paper chromatography

4. TLC of herbal extract

5. Distillation of volatile oils and detection of phytoconstituents by TLC

6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Learning Experience

The "Pharmacognosy & Phytochemistry II" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of natural products and their chemical properties.

In-Depth Study of Natural Products: The course covers advanced topics related to the chemistry of medicinal plants, including secondary metabolites, alkaloids, glycosides, and essential oils.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding of how natural products impact health and disease.

Industry Relevance: The course prepares students for careers in pharmaceuticals, herbal medicine, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Pharmacognosy & Phytochemistry II" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of natural products.

Textbooks

1. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
2. Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
3. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
4. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
5. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

Suggested Readings

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. https://books.google.co.in/books?id=fDJlDwAAQBAJ&lpg=PP1&ots=S20Vifahdt&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA7#v=onepage&q&f=false
2. https://books.google.co.in/books?id=UmOoJ0kQo74C&lpg=PA1&ots=OB1lTEDNXa&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA1#v=onepage&q&f=false
3. https://books.google.co.in/books?id=NZXQAQAAQBAJ&lpg=PP1&ots=pmFsBQxpee&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PP1#v=onepage&q&f=false

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	3 hrs.	10
2	Continuous Mode - Attendance	-	2
3	Continuous Mode - Student-Teacher interaction	-	3
4	End Term Examination	3 hr.	35
Total			**50**

Semester V					
BP501T	**Medicinal Chemistry –II**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**-**	**4**
Category of Course	Core Course				
Total Contact Hours	45 hours				
Pre-Requisites/ Co-Requisites					

Course Perspective: Medicinal Chemistry-II focuses on the advanced concepts and applications of medicinal chemistry in drug design and development. This course emphasises on synthesis and modification of chemical compounds to enhance their therapeutic properties, mechanism of action, and chemical synthesis of various classes of drugs.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the chemistry of drugs with respect to their pharmacological activity

CO 2: Applying the medicinal fundamentals in the chemical synthesis of selected drugs

CO 3: Analysing structure-activity relationships (SAR) and how chemical modifications can influence the pharmacological activity of drugs.

CO 4: Evaluating structure-based drug design principles to propose modifications that can enhance a drug's affinity for its target.

Course Content

UNIT I **10 Hours**

Antihistaminic agents:

Histamine, receptors and their distribution in the human body

H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole Anti-neoplastic agents:

Alkylating agents: Mecloretha mine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane

UNIT II **10 Hours**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

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

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan

UNIT IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil. Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone **Thyroid and antithyroid drugs:** L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT V **07 Hours**

Antidiabetic agents:

Insulin and its preparations Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. **Glucosidase inhibitors:** Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. **Miscellaneous:** Phenacaine, Diperodon, Dibucaine.

Learning outcomes

Students will be able to understand the structure and synthesis of organic compounds relevant to pharmaceuticals.Students will learn structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs

Students will analyse the mechanisms by which drugs interact with their biological targets, such as enzymes or receptors, to produce therapeutic effects.

Textbooks

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV
4. Introduction to principles of drug design- Smith and Williams.
5. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5
6. Organic Chemistry by I.L. Finar, Vol. II
7. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5
8. Remington's Pharmaceutical Sciences.

Open Educational Resources (OER)

1. https://pharmdbm.com/medicinal-chemistry-2-notes-download-pdf/
2. https://brightmedico.com/free-best-handwritten-notes/b-pharmacy-notes-pdf-free-download/5th-semester-medicinal-chemistry/3.
3. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP501T_MEDCHEM_-UNIT-_IV.pdf

Evaluation Scheme Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessional I & II	1 hr.	15	
2	Continuous Mode - Attendance	-	4	
3	Continuous Mode - Student-Teacher interaction	-	3	
4	Continuous mode - Assignment	-	3	
5	End Term Examination	3 hr.	75	
Total			100	

Semester V					
BP502 T	**Industrial Pharmacy-I**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	**Pharmaceutics**				
Total Contact Hours	**45 hours**				
Pre-Requisites/ Co-Requisites	**Industrial Pharmacy**				

Course Perspective

This course equips students with essential knowledge and skills for developing stable and effective pharmaceutical formulations, addressing both theoretical and practical aspects of dosage form design. Through understanding of pre-formulation studies, physicochemical properties, and quality control processes, students gain the ability to innovate and troubleshoot across various dosage forms. Emphasis on packaging and stability ensures students are prepared to meet regulatory standards and deliver safe, high-quality products.

Course Outcomes:

Upon completion of the course the learner will be able to:

CO1 – Understanding of various principles and properties essential for formulation development.

CO2 - Applying knowledge in developing basic formulations using appropriate excipients and techniques.

CO3 – Analysing different quality control requirements for dosage forms to ensure stability and compliance.

CO4 - Evaluating formulation’s quality, stability and packaging needs for quality assurance.

Course Content

UNIT-I **07Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemization, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT-II **10 Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-III **08Hours**

Capsules:

a. 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.

b. Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV **10Hours**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b. Production procedure, production facilities and controls, aseptic processing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10 Hours**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair

dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

Learning Experience:

1. Methods of Instruction:

- **Interactive Lectures:** The course will be conducted through a combination of interactive lectures and discussions. The instructor will use multimedia presentations to explain complex concepts, integrating real-world examples from the pharmaceutical industry to make the material more relatable and engaging.
- **Case Studies:** Students will analyze real-life case studies related to drug formulation, manufacturing challenges, and quality control issues. This will help them apply theoretical knowledge to practical situations and develop problem-solving skills.

2. Use of Technology:

- **Virtual Simulations:** To enhance the learning experience, virtual simulations of pharmaceutical manufacturing processes will be used. These simulations will allow students to visualize and interact with different stages of drug formulation and production, providing a hands-on learning experience without the need for physical lab resources.
- **Learning Management System (LMS):** The course will utilize an LMS for distributing course materials, assignments, and announcements. Students can access video lectures, reading materials, and participate in discussion forums, allowing them to learn at their own pace.

3. Experiential and Participatory Learning:

- **Hands-on Laboratory Sessions:** Students will participate in lab sessions where they will formulate and evaluate various dosage forms such as tablets, capsules, and parenteral products. These hands-on activities will reinforce the theoretical concepts covered in lectures and provide practical experience in pharmaceutical formulation and quality control.
- **Group Work and Collaboration:** Students will engage in group projects where they will work together to solve formulation challenges, design experiments, and present their findings. This collaborative approach fosters teamwork and communication skills, essential for success in the pharmaceutical industry.
- **Peer Reviews:** Students will participate in peer review sessions where they will evaluate each other's work, providing constructive feedback and gaining different perspectives on problem-solving.

4. Assignments and Activities:

- **Formulation Projects:** Students will be assigned formulation projects where they will develop a prototype of a pharmaceutical product, considering factors like drug stability, excipient compatibility, and packaging. These projects will require students to integrate knowledge from different units of the course.
- **Case Study Analysis:** Regular case study assignments will encourage students to apply theoretical knowledge to real-world scenarios, such as troubleshooting formulation issues or optimizing manufacturing processes.
- **Presentations:** Students will present their project findings and case study analyses to the class, developing their presentation and communication skills.

Textbooks/ Reference Books/Materials

1. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

2. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
3. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman&Lachman
4. Pharmaceutical dosage form disperse system VOL-1 by Liberman& Lachman
5. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
6. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
7. Theory and Practice of Industrial Pharmacy by Liberman& Lachman
8. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
9. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005

Suggested Readings

Open Educational Resources (OER)

16. https://www.slideshare.net/nitinkadam3/tablets
17. https://www.slideshare.net/PRABU12345678/capsules-105565461
18. http://www.ijpsr.info/docs/IJPSR15-06-08-004.pdf
19. https://ieeexplore.ieee.org/abstract/document/9117614
20. https://www.mdpi.com/2073-4360/12/3/699
21. https://www.ingentaconnect.com/content/ben/iad/2014/00000008/00000001/art00007
22. https://www.slideshare.net/shubhrajit/opthalmic-preparation
23. https://www.slideshare.net/AnujKoli2/pellets-industrial-pharmacy

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Semester V					
BP503 T	**Pharmacology II– Theory**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pharmacology-I/ Human Anatomy & Physiology				

Course Perspective

Pharmacology is the study of how drugs interact with biological systems, and it can be approached from various perspectives depending on your focus. Here's an overview of how these fields support each of these areas:

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding the Knowledge of drugs and their mechanism of actions

CO2. Applying the concept of drugs for the treatment of diseases

CO3. Analyzing mechanism of drugs along with clinical uses and their adverse effects

CO4. Evaluating the various drug using latest analytical techniques.

Course Content

Unit I: **10 Hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamic and electrophysiology of heart.

b. Drugs used in congestive heart failure

c. Anti-hypertensive drugs.

d. Anti-anginal drugs.

e. Anti-arrhythmic drugs.

f. Anti-hyperlipidemic drugs

Unit II: **10 Hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Drug used in the therapy of shock.

b. Hematinics, coagulants and anticoagulants.

c. Fibrinolytics and anti-platelet drugs

d. Plasma volume expanders

2. Pharmacology of drugs acting on urinary system

a. Diuretics

b. Anti-diuretics.

Unit III: **10 Hours**

3. Autocoids and related drugs

a. Introduction to autacoids and classification

b. Histamine, 5-HT and their antagonists.

c. Prostaglandins, Thromboxanes and Leukotrienes.

d. Angiotensin, Bradykinin and Substance P.

e. Non-steroidal anti-inflammatory agents

f. Anti-gout drugs

g. Antirheumatic drugs

Unit IV: **08 Hours**

4. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.

b. Anterior Pituitary hormones- analogues and their inhibitors.

c. Thyroid hormones- analogues and their inhibitors.

d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.

d. Insulin, Oral Hypoglycemic agents and glucagon.

e. ACTH and corticosteroids.

Unit V: **07 Hours**

5. Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.

b. Estrogens, progesterone and oral contraceptives.

c. Drugs acting on the uterus.

6. Bioassay

a. Principles and applications of bioassay.

b. Types of bioassay

c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d- tubocurarine,digitalis, histamine and 5-HT

Learning Experience

The "Pharmacology-II" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of drugs and their mechanism of action.

In-Depth Study of mechanism of action of drugs: The course covers understanding to identify new drug targets and develop novel compounds. This involves screening for potential interactions and optimizing drug candidates based on their mechanism of action.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding how drugs interact with the immune system, influencing immune responses and autoimmune conditions

Industry Relevance: The course prepares students for careers in pharmaceuticals, synthetic drugs and natural products, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Pharmacology-II" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of drugs and their mechanism of action.

Textbooks

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

3. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Suggested Readings

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP503T_PGPC_UNIT_I.pdf
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

SEMESTER V					
BP504 T	**Pharmacognosy and Phytochemistry II– Theory**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pharmacognosy & Phytochemistry-I / Remedial Biology				

Course Perspective

Pharmacognosy and phytochemistry are disciplines that can greatly enhance a student's academic, career, and professional growth. Here's an overview of how these fields support each of these areas:

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding modern extraction techniques for isolation and identification of phytoconstituents.

CO2. Applying the techniques intent to preparation and development of herbal formulation

CO3. Analyzing the herbal formulation for the production, estimation and utilization of phytoconstituents.

CO4. Evaluating the phytoconstituents using chromatographic and spectrophotometric techniques.

Course Content

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolitesthrough these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathways.

b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14 Hours**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphtha quinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrhetinic acid & Rutin

c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine

d) Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine,

Taxol, Vincristine and Vinblastine

UNIT V **8 Hours**

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

Learning Experience

The "Pharmacognosy & Phytochemistry II" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of natural products and their chemical properties.

In-Depth Study of Natural Products: The course covers advanced topics related to the chemistry of medicinal plants, including secondary metabolites, alkaloids, glycosides, and essential oils.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding of how natural products impact health and disease.

Industry Relevance: The course prepares students for careers in pharmaceuticals, herbal medicine, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Pharmacognosy & Phytochemistry II" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of natural products.

Textbooks

1. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
2. Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
3. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
4. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
5. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi,2005.

Suggested Readings

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. **https://books.google.co.in/books?id=fDJlDwAAQBAJ&lpg=PP1&ots=S20Vifahdt&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA7#v=onepage&q&f=false**
2. **https://books.google.co.in/books?id=UmOoJ0kQo74C&lpg=PA1&ots=OB1lTEDNXa&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA1#v=onepage&q&f=false**
3. **https://books.google.co.in/books?id=NZXQAQAAQBAJ&lpg=PP1&ots=pmFsBQxpee&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PP1#v=onepage&q&f=false**

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester V					
BP505 T	Pharmaceutical Jurisprudence (Theory)	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	PHARMACEUTICAL JURISPRUDENCE				

Course Perspective

Pharmaceutical Jurisprudence is a field that explores the legal aspects of pharmacy practice and drug development. A course in Pharmaceutical Jurisprudence typically covers the intersection of law and pharmacy, focusing on regulations, ethical issues, and legal practices that affect the pharmaceutical industry

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding fundamental knowledge on Various Act in pharmaceutical sciences

CO2. Applying the rules and regulation to various disciplines of pharmacy.

CO3. Analysing the roles of jurisprudence in subject deals with pharmaceutical products.

CO4. Evaluating the jurisprudence in context to the new drugs

CO5. Creating guidelines and rules for the new drugs.

Course Content

UNIT-I **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.

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.

UNIT-II 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA).

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.

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

UNIT-III 10 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.

Medicinal and Toilet Preparation Act –1955: 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: 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 **08 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: 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)

UNIT-V 07 Hours

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

LEARNING EXPERIENCE:

Taking a course in pharmaceutical jurisprudence can be a unique and enriching learning experience. This field blends elements of law with pharmaceutical science, aiming to ensure that medications are used safely and ethically. Here's an overview of what one might experience and learn in such a course

1. **Legal Frameworks and Regulations**

   Students get familiar with the laws and regulations governing the practice of pharmacy, including federal and state regulations, roles of agencies like the FDA or EMA about drug approval

2. **Ethical and Professional Standards**

   Exploring ethical dilemmas in pharmacy practice, such as patient confidentiality and informed consent and responsibilities in ensuring ethical practice and professional conduct.

3. **Legal procedures and Documentation**

   Understanding about proper documentation practices including patient and prescription record, consent forms and their implications and etc.

   Record Keeping: Learning about proper documentation practices, including prescription records and patient records.

4. **Regulatory Agencies and Their Roles**

Studying the roles of various regulatory agencies and how they influence pharmaceutical practice and understanding how compliance is monitored and addressing of violations.

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh

2. Text book of Forensic Pharmacy by B.M. Mithal

3. Hand book of drug law-by M.L. Mehra

4. A text book of Forensic Pharmacy by N.K. Jain

5. Drugs and Cosmetics Act/Rules by Govt. of India publications.

6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.

7. Narcotic drugs and psychotropic substances act by Govt. of India publications

8. Drugs and Magic Remedies act by Govt. of India publication

9.Bare Acts of the said laws published by Government. Reference books (Theory

Evaluation Scheme

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/ Extempore)	-	10	-
2	Sessional I/II Examination (Written Examination)	1 hr	15	-
3	End Term Examination (Written Examination)	3 hrs	75	-
	Total		100	-

Semester V					
BP506P	**Industrial Pharmacy-I (Practical)**	**L**	**T**	**P**	**C**
Version	**2.0**	**0**	**0**	**4**	**2**
Category of Course	**Pharmaceutics**				
Total Contact Hours	**45 Hours**				
Pre-Requisites/ Co-Requisites	**Industrial Pharmacy/ Pharmaceutical Dosage forms and techniques**				

Course Perspective

This course is designed to build foundational skills in pharmaceutical formulation and dosage form development. Students will learn key principles of pre-formulation, manufacturing techniques, and quality control, ensuring they understand both the science and practical application behind creating stable, effective, and safe pharmaceuticals. Emphasis is placed on regulatory standards and quality assurance, preparing students to meet industry requirements and contribute to patient safety. This knowledge is essential for careers in pharmacy, product development, and pharmaceutical research.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1 – Applying the principles and objectives of pre-formulation studies for formulation stability.

CO2 - Analysing and comparing quality control tests for dosage forms and glass containers to ensure regulatory compliance.

CO3 - Evaluating the quality and stability of various formulations.

CO4 - Creating stable dosage forms based on pre-formulation study insights.

Course Content **4 hours/week**

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)

Learning Experience

The course will be conducted through a blend of lectures, hands-on laboratory sessions, and interactive group work to ensure experiential and participatory learning. Students will engage in practical tasks, such as formulating and evaluating tablets, injections, and other dosage forms, using modern lab equipment and technology. Case studies will be integrated to link theory with real-world pharmaceutical challenges, fostering critical thinking. Group activities, peer reviews, and collaborative projects will encourage teamwork and knowledge-sharing. Assignments and practical assessments will be used to evaluate understanding, with ongoing feedback provided to guide progress. The course in charge will be available for additional support, and students are encouraged to seek assistance when needed, ensuring a continuous learning loop.

Textbooks

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B.Schwartz

2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman

3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman

4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition

5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)

6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman

7. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill livingstone, Latest edition

8. Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5thedition, 2005

9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Suggested Readings

1. Theory and Practice of Industrial Pharmacy by Liberman & Lachman

2. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill livingstone, Latest edition

Open Educational Resources (OER)

1. **https://mlrip.ac.in/wp-content/uploads/2022/03/INDUSTRIAL-PHARMACY-LAB-MANUAL.pdf**
2. **https://books.google.co.in/books?id=5nIJEAAAQBAJ&printsec=copyright&redir_esc=y#v=onepage&q&f=false**
3. **https://www.kopykitab.com/Sample-PDF-Laboratory-Manual-of-Industrial-Pharmacy-by-Dr-Bharati-Bakde-Dr-Anil-Chandewar-Dr-Brahmeshwar-Mishra**

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Semester V					
BP507 P	**Pharmacology-II**	**L**	**T**	**P**	**C**
Version	2.0	**-**	**-**	**4**	**2**
Category of Course	Practical				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Pharmacology I and II, Pathophysiology				

Course Perspective:

It encompasses the study of drug development, pharmacokinetics, and pharmacodynamics, providing essential knowledge for healthcare professionals to ensure safe and effective medication management. This field bridges science and clinical practice, ultimately aiming to improve patient outcomes.

Course outcome

CO1. Understanding the pharmacological actions of different categories of drugs

CO2. Applying the mechanism of drug action at organ system/sub cellular/ macromolecular levels.

CO3. analyzing the basic pharmacological knowledge in the prevention and treatment of various diseases.

CO4. Evaluating the effect of drugs on animals by simulated experiments

CO5. Creating correlation of pharmacology with other bio medical sciences

Course Content

4Hrs/Week

1. Introduction to in-vitro pharmacology and physiological salt solutions.

2. Effect of drugs on isolated frog heart.

3. Effect of drugs on blood pressure and heart rate of dog. 4. Study of diuretic activity of drugs using rats/mice. 5. DRC of acetylcholine using frog rectus abdominis muscle.

6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.

7. Bioassay of histamine using guinea pig ileum by matching method.

8. Bioassay of oxytocin using rat uterine horn by interpolation method.

9. Bioassay of serotonin using rat fundus strip by three-point bioassay.

10. Bioassay of acetylcholine using rat ileum/colon by four-point bioassay.

11. Determination of PA2 value of prazosin using rat anococcygeal muscle (by Schilds plot method).

12. Determination of PD2 value using guinea pig ileum.

13. Effect of spasmogens and spasmolytics using rabbit jejunum.

14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.

15. Analgesic activity of drug using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software and video

Learning Experience

In-Depth Study of mechanism of action of drugs

Interdisciplinary Approach

Industry Relevance

Textbooks

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

3. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Suggested Readings

1. lnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
2. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
3. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert.

Open Educational Resources (OER)

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP503T_PGPC_UNIT_I.pdf
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/
4. Ex Pharm Software

Evaluation Scheme

S. No.	**Evaluation Component**	**Duration**	**Weightage (%)**
1	Sessional I & II	4 hr.	10
2	Continuous Mode – Attendance	-	2
3	Continuous Mode – viva- voce	-	3
4	End Term Examination	4 hr.	35
Total			**50**

Semester V					
BP508P	**Pharmacognosy and Phytochemistry II– Practical**	**L**	**T**	**P**	**C**
Version 2.0		**0**	**0**	**4**	**2**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pharmacognosy & Phytochemistry-I / Remedial Biology (Practical)				

Course Perspective. Pharmacognosy and phytochemistry are disciplines that can greatly enhance a student's academic, career, and professional growth. Here's an overview of how these fields support each of these areas:

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding procedures for identification of the herbal drugs

CO2. Applying their knowledge for identification of the herbal drugs.

CO3. Analyzing the crude drugs with their chemical nature & activities

CO4. Evaluating and various Phytoconstituents by chromatographic Techniques

Course Content

Morphology, histology and powder characteristics & extraction & detection of:

Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander

2. Exercise involving isolation & detection of active principles

a. Caffeine - from tea dust.

b. Diosgenin from Dioscorea

c. Atropine from Belladonna

d. Sennosides from Senna

3. Separation of sugars by Paper chromatography

4. TLC of herbal extract

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

Learning Experience

The "Pharmacognosy & Phytochemistry II" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of natural products and their chemical properties.

In-Depth Study of Natural Products: The course covers advanced topics related to the chemistry of medicinal plants, including secondary metabolites, alkaloids, glycosides, and essential oils.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding of how natural products impact health and disease.

Industry Relevance: The course prepares students for careers in pharmaceuticals, herbal medicine, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Pharmacognosy & Phytochemistry II" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of natural products.

Textbooks

1. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
2. Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
3. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
4. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
5. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

Suggested Readings

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. https://books.google.co.in/books?id=fDJlDwAAQBAJ&lpg=PP1&ots=S20Vifahdt&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA7#v=onepage&q&f=false
2. https://books.google.co.in/books?id=UmOoJ0kQo74C&lpg=PA1&ots=OB1lTEDNXa&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PA1#v=onepage&q&f=false
3. https://books.google.co.in/books?id=NZXQAQAAQBAJ&lpg=PP1&ots=pmFsBQxpee&dq=Open%20Educational%20Resources%20(OER)%20pHARMACOGNOSY%20%26%20PHYTOCHEMISTRY%20II&lr&pg=PP1#v=onepage&q&f=false

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	3 hrs.	10
2	Continuous Mode - Attendance	-	2
3	Continuous Mode - Student-Teacher interaction	-	3
4	End Term Examination	3 hr.	35
Total			**50**

BP601T	Medicinal Chemistry-III	L	T	P	C
Version	**2.0**	3	1	0	4
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Organic Chemistry				

Course perspective

This course provides a foundational understanding of drug structure, chemistry, and therapeutic effects. It also introduces modern drug design techniques, including QSAR, prodrug concepts, combinatorial chemistry, and CADD. Upon completion of this course, students will be able to design and synthesize medically important compounds.

Course Outcomes

CO1: Understanding the synthetic procedures, mechanisms of action, metabolism, and adverse effects of different classes of drugs.
CO2: Applying knowledge of structure-activity relationships (SAR) to predict the biological activity of drugs.
CO3: Analyzing the SAR of different classes of drugs to assess the impact of chemical substituents on biological activity.
CO4: Evaluating the therapeutic potential of drugs based on their chemical structure and pharmacokinetic properties.
CO5: Creating knowledge for designing of novel drug molecules using a computer-aided drug design approach.

Course Content

UNIT – I (10 Hours)

Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β-Lactam antibiotics: Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II (10 Hours)

Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin Clarithromycin, Azithromycin. Miscellaneous: Chloramphenicol*, Clindamycin. Prodrugs: Basic concepts and application of prodrugs design. Antimalarials: Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III (10 Hours)

Anti-tubercular Agents Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate. Urinary tract anti-infective agents Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine. Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir.

UNIT – IV (08 Hours)

Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole. Sulfones: Dapsone*

UNIT – V (07 Hours)

Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis.

Learning Experiences

In this course, students will explore medicinal chemistry through interactive lectures, case studies, and problem-solving sessions focused on drug design and synthesis. Simulation of QSAR and CADD approaches will enhance critical thinking and design of new compounds. These activities aim to foster a comprehensive understanding of the principles and applications of medicinal chemistry.

Textbooks and Reference books

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II. 8

Suggested Readings

https://www.researchgate.net/publication/272193251_Target_Based_Drug_Design_-_A_Reality_in_Virtual_Sphere

https://pubs.rsc.org/en/content/articlelanding/2016/ra/c6ra00846a

https://pubs.rsc.org/en/content/articlehtml/2019/md/c9md00120d

https://pubs.rsc.org/en/content/articlelanding/2020/cs/c9cs00556k/unauth

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	1	10	
2	Sessional (Written Examination)	60 minutes	15	
4	End Term Examination (Written Examination)	180 minutes	75	
Total			**100**	

BP602 T	Pharmacology-III	L	T	P	S	C
Version	2.0	3	1	0	0	4
Category of Course	Core					
Total Contact Hours	45 hrs					
Pre-Requisites/ Co-Requisites	Human Anatomy and Physiology					

Course perspective

This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.

Course outcomes

Upon completion of this course the student should be able to

1. Understanding the mechanism of drug action and its relevance in the treatment of different diseases
2. Applying the concept in the isolation of different organs/tissues from the laboratory by animals simulated experiments
3.Analysing the various receptor actions using isolated tissue preparation
4. Evaluating correlation of pharmacology with related medical sciences

SYLLABUS

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs

b. Drugs used in the management of COPD

c. Expectorants and antitussives

d. Nasal decongestants

e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.

b. Drugs for constipation and diarrhoea.

c. Appetite stimulants and suppressants.

d. Digestants and carminatives.

e. Emetics and anti-emetics.

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy.

b. Sulfonamides and cotrimoxazole.

c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III **10hours**

3. Chemotherapy

a. Antitubercular agents

b. Antileprotic agents

c. Antifungal agents

d. Antiviral drugs

e.Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV **08hours**

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases.

m. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07hours**

5. Principles of toxicology

a. Definition and basic knowledge of acute, subacute and chronic toxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning

6. Chronopharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

Textbook

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill.

3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.

5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.

6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Reference Books/Materials

(1) Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.

(2) K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

(3) Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher

(4) Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.

Online Reference:

1. https://www.britannica.com/science/growth-hormone
2. https://www.hindawi.com/journals/aps/
3. https://benthamopen.com/contents/pdf/TOEJ/TOEJ-6-3.pdf
4. https://www.slideshare.net/reynel89/chemotherapy-11954817
5. https://www.slideshare.net/arijabuhaniyeh/gi-drugs-pharmacology
6. https://www.slideshare.net/Shivam1995Diwaker/pharmacology-of-free-radicals
7. https://www.msdmanuals.com/en-in/professional/neurologic-disorders/delirium-and-dementia/alzheimer-disease#:~:text=Pathophysiology%20of%20Alzheimer%20Disease&text=The%20beta%2Damyloid%20deposition%20and,at%20the%20mesial%20temporal%20lobe.
8. https://notesmed.com/wp-content/uploads/2020/08/Essentials-of-Medical-Pharmacology-8th-Edition..pdf
9. https://www.slideshare.net/meducationdotnet/clinical-pharmacology-therapeutics-revision-notes
10. https://ocw.mit.edu/courses/hst-151-principles-of-pharmacology-spring-2005/pages/lecture-notes/
11. https://www.mypharmaguide.com/pharmacology-pdf-notes-free-download/
12. https://www.thefuturepharmacist.com/2021/06/pharmacology-i-theory-bp-404-t-semester.html
13. https://www.researchgate.net/publication/325069109_Unit_I_PHARMACOLOGY_TOXICOLOGY
14. https://medicalsciences.med.unsw.edu.au/sites/default/files/soms/page/Undergrad/2013-PHAR2011-course-outline.pdf
15. https://www.physio-pedia.com/Pharmacological_management_of_Diabetes_Mellitus
16. https://www.nature.com/articles/nrendo.2016.86

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Written Examination (Sessional I and II)	60 Minutes	15	
2	Continuous Mode		10	
3	End Term Examination	180 Minutes	75	
Total			**100**	

Semester VI					
BP603T	**Herbal Drug Technology – Theory**	**L**	**T**	**P**	**C**
Version	2.0	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Pharmacognosy & Phytochemistry-I & II (Theory)				

Course Perspective

Herbal drug technology is a discipline that can greatly enhance a student's academic, career, and professional growth. Herbal drug technology provides a deep understanding of natural products and their roles in medicine. Here’s an overview of how these fields support each of these areas:

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding raw material as source of herbal drugs from cultivation to herbal drug product.

CO2. Applying WHO and ICH guidelines for evaluation of herbal drugs.

CO3. Analysing the quality of herbal cosmetics, natural sweeteners and nutraceuticals.

CO4. Evaluating the scope of patenting of herbal drugs, GMP

CO5. Creating novel herbal formulations and Herbal cosmetics and reducing the adverse effects.

Course Content

UNIT I **(Lectures- 11)**

Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials Processing of herbal raw material Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma

UNIT II **(Lectures- 10)**

Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina 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.

UNIT III **(Lectures- 10)**

Herbal Cosmetics 134 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. Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. Herbal formulations : Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT IV **(Lectures- 8)**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNITV **(Lectures-7)**

General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

Learning Experience

The "Herbal Drug Technology" course typically builds on foundational knowledge from earlier coursework, diving deeper into the study of natural products and their chemical properties.

In-Depth Study of Natural Products: The course covers advanced topics related to the chemistry of medicinal plants, including secondary metabolites, alkaloids, glycosides, and essential oils.

Interdisciplinary Approach: The course integrates knowledge from chemistry, biology, pharmacology, and medicine, fostering a comprehensive understanding of how natural products impact health and disease.

Industry Relevance: The course prepares students for careers in pharmaceuticals, herbal medicine, and biotechnology by providing relevant knowledge and skills applicable in these fields.

Overall, "Herbal Drug Technology" offers a comprehensive and hands-on learning experience, bridging the gap between theoretical knowledge and practical application in the study of natural products.

Textbooks

1. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
2. Textbook of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
3. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
4. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
5. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

Suggested Readings

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

2. Textbook of Pharmacognosy by T.E. Wallis

Open Educational Resources (OER)

1. https://www.pharmalite.in/2022/03/bp603t-herbal-drug-technology-books.html
2. https://repository.poltekkes-kaltim.ac.id/1148/1/Handbook%20of%20Medicinal%20Herbs%20(%20PDFDrive%20).pdf

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester V I					
BP 604 T	**Biopharmaceutics and Pharmacokinetics**	**L**	**T**	**P**	**C**
Version 2.0		3	1	0	0
Category of Course	Core				
Total Contact Hours	45 hrs				
Pre-Requisites/ Co-Requisites	Principles of Drug Action				

Course Perspective

Biopharmaceutics and pharmacokinetics deals absorption, distribution, metabolization, and elimination from the body, and how these processes affect drug efficacy and safety.

Course Outcomes

On completion of this course, the student will be able to:

CO1. Understanding the basic concepts in Biopharmaceutics and pharmacokinetics and their significance.

CO2. Applying the techniques to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, and elimination.

CO3. Analysing the bioavailability and bioequivalence of drug products and their significance**.**

CO4. Evaluating entrepreneurship skills that support the growth of the Pharmaceutical Industry

CO5. Creating the novel method to calibrate the pharmacokinetic parameters using the Compartment Model.

Course Content

Unit-1 **Lectures:10**

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs.

Unit-2 **Lectures: 10**

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug

dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs

Unit-3 **Lectures: 10**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE ,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application.

Unit-4 **Lectures: 08**

Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

Unit-5: **Lectures: 07**

a**.** Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Learning Experience

1.Theoretical Foundations

- **Biopharmaceutics** and **pharmacokinetics** involve understanding complex scientific principles, so the initial learning phase focuses on grasping core concepts like drug absorption, distribution, metabolism, excretion (ADME), and mathematical modeling.
- **Lectures & Readings:** You'll study key topics such as bioavailability, therapeutic windows, compartmental models, first-pass metabolism, and clearance mechanisms.
- **Pharmacokinetic Models:** You'll engage with mathematical models that describe the movement of drugs in the body, which can be difficult but are essential for predicting how a drug behaves in different scenarios (e.g., in a healthy vs. diseased state).

2. Hands-On Laboratory Work

- **Practical Application:** Lab sessions are integral to learning these subjects. You will perform experiments to measure drug absorption, distribution, and elimination, using methods such as **HPLC (High-Performance Liquid Chromatography)** or **mass spectrometry**.
- **In Vitro and In Vivo Studies:** You'll conduct studies that simulate how drugs behave in the human body. In vitro studies use cells or tissues, while in vivo involves animal models or clinical settings.

3. Problem-Solving & Data Analysis

- **Pharmacokinetic Data Interpretation:** You will learn to interpret pharmacokinetic parameters like **Cmax** (peak concentration), **Tmax** (time to reach Cmax), **half-life**, and **area under the curve (AUC)** to make informed decisions on dosing regimens.
- **Mathematical Modeling & Simulation:** Using software tools (e.g., WinNonlin, PKSolver), you will simulate drug concentration profiles and apply models to predict drug interactions, dosing adjustments, and bioequivalence.

4. Interdisciplinary Learning

- **Pharmacology, Biochemistry, and Physiology Integration:** Biopharmaceutics and pharmacokinetics require a strong understanding of how drugs interact with biological systems, so your learning will integrate concepts from related fields like biochemistry (drug metabolism), physiology (organ functions), and pharmacology (drug action).
- **Collaborative Projects:** You may work in interdisciplinary teams to design drug formulations or optimize dosing strategies, leveraging knowledge from chemistry, biology, and pharmacology.

5. Use of Technology and Simulation Tools

- **Computational Pharmacokinetics:** You will use software to predict how drugs will behave in the body, often before animal or human testing. This is crucial for dose prediction, scaling from preclinical to clinical stages, and regulatory submission.
- **Pharmacokinetic Software:** Tools like **NONMEM** or **Phoenix WinNonlin** help to analyze clinical trial data and simulate how changes in dosage or patient characteristics affect drug behavior.

6. Regulatory and Ethical Considerations

- **Regulatory Standards:** Understanding the guidelines set by organizations like the **FDA** or **EMA** is essential. You'll study case examples of regulatory submissions to see how pharmacokinetic and biopharmaceutics data play a role in drug approval.
- **Ethical Issues:** Some learning may focus on ethical concerns in drug testing, particularly when moving from animal models to human trials, or when dealing with vulnerable populations.

Textbooks

1. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
2. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi\
3. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.

4. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

Suggested Readings

1. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc. 6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
2. Biopharmaceutics; By SwarbrickClinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
3. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.

Open Educational Resources (OER)

1. https://www.sciencedirect.com/science/article/pii/S0025712516320880/pdf?md5=ea2ec7be47420bdf723b7793556a4240&pid=1-s2.0-S0025712516320880-main.pdf
2. https://derangedphysiology.com/main/cicm-primary-exam/required-reading/pharmacokinetics/Chapter%20131/factors-which-influence-gastrointestinal-drug-absorption
3. https://www.ncbi.nlm.nih.gov/books/NBK557405/
4. https://www.msdmanuals.com/en-in/professional/clinical-pharmacology/pharmacokinetics/drug-distribution-to-tissues
5. https://pubmed.ncbi.nlm.nih.gov/6519129/
6. https://pubmed.ncbi.nlm.nih.gov/12473961/
7. https://www.ncbi.nlm.nih.gov/books/NBK442023/
8. https://www.ncbi.nlm.nih.gov/books/NBK547662/
9. https://www.msdmanuals.com/en-in/professional/clinical-pharmacology/pharmacokinetics/drug-excretion
10. https://www.ncbi.nlm.nih.gov/books/NBK544353/

11. https://derangedphysiology.com/main/cicm-primary-exam/required-reading/pharmacokinetics/Chapter%203355/phase-i-and-phase-ii-biotransformation-reactions
12. https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/renal-excretion
13. https://accesspharmacy.mhmedical.com/content.aspx?legacysectionid=ShargBio8_ch8#:~:text=PURPOSE%20OF%20BIOAVAILABILITY%20AND%20BIOEQUIVALENCE%20STUDIES,-%2B%2B&text=Bioavailability%20data%20provide%20an%20estimate,or%20more%20drug%20product%20formulations.
14. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9495787/
15. https://www.sciencedirect.com/science/article/pii/S1877050921008115/pdf?md5=2cbd0f1f8a72283e205476302cfee493&pid=1-s2.0-S1877050921008115-main.pdf

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester VI					
BP605T	**Pharmaceutical Biotechnology**	**L**	**T**	**P**	**C**
Version	2	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Biology, Microbiology				

Course Perspective

This course explores advanced biological processes and their application in drug innovation. It emphasizes practical implementation of biotechnical methods and addresses ethical, regulatory, and societal impacts. It will help in developing critical thinking skills to contribute to future healthcare advancements.

Course outcomes

CO1: Understanding the principles of biotechnology and its applications in the development of healthcare products.

CO2: Applying biotechnological techniques in drug development and production processes.

CO3: Analyzing different biotechnological methods and their impact on the efficiency and safety of pharmaceutical products.

CO4: Evaluating ethical, regulatory, and societal implications of biotechnology in the pharmaceutical industry.

Course Content

Unit I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.

c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.

d) Brief introduction to Protein Engineering.

e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.

f) Basic principles of genetic engineering.

Unit II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine.

c) Application of r DNA technology and genetic engineering in the production of:

i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.

d) Brief introduction to PCR

Unit III 10 Hours

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins

b) Structure and Function of MHC

c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.

d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.

e) Storage conditions and stability of official vaccines

f) Hybridoma technology- Production, Purification and Applications

g) Blood products and Plasma Substituties.

Unit IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.

b) Genetic organization of Eukaryotes and Prokaryotes

c) Microbial genetics including transformation, transduction, conjugation, plasmids and

transposons.

d) Introduction to Microbial biotransformation and applications.

e) Mutation: Types of mutation/mutants.

Unit V **07 Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.

b) Large scale production fermenter design and its various controls.

c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,

d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.

Learning Experience

- **Hands-on Laboratory Work**: Students gain practical experience with immunoblotting techniques and vaccine production.
- **Case Studies and Problem-Solving**: Analyzing real-world cases of immune responses and microbial genetics.
- **Simulation of Fermentation Processes**: Simulating fermentation for biotechnological products and studying fermenter design.
- **Collaborative Learning**: Group projects on vaccine and fermentation topics to encourage teamwork.
- **Interactive Discussions and Presentations**: Engaging in discussions and presentations on immunology and biotechnology.
- **Research and Innovation Projects**: Conducting research on hybridoma technology and vaccine innovations.
- **Use of Technological Tools**: Utilizing digital tools for data analysis in genetic and microbial studies.

Textbooks

1. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry. 5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
2. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
3. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

Suggested Readings

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2. RA Goldshy et. al., Kuby Immunology. 3. J.W. Goding: Monoclonal Antibodies.

Open Educational Resources (OER)

1. OpenStax: Biology 2e - Immune System
2. MIT Open Course Ware: Genetics

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	1 hr.	15
2	Continuous Mode - Attendance	-	4
3	Continuous Mode - Student-Teacher interaction	-	3
4	Continuous mode - Assignment	-	3
5	End Term Examination	3 hr.	75
Total			**100**

Semester VI					
BP 606T	**Quality Assurance-Theory**	**L**	**T**	**P**	**C**
Version	2.0	**3**	**1**	**0**	**4**
Category of Course	Core Course				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	**Pharmaceutics**				

Course Perspective

This course deals in pharmacy typically covers the principles and practices essential for ensuring the quality of pharmaceutical products.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the cGMP aspects in a pharmaceutical industry

CO 2: Applying the principles of cGMP pharmaceutical formulation to formulate the quality product

CO 3: Analysing the quality certifications applicable to pharmaceutical industries

CO 4: Evaluating the QA & QC pharmaceutical formulations.

Course Content

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, ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines Quality by design (QbD): Definition, overview, elements of QbD program, tools ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration NABL accreditation : Principles and procedures

UNIT - II **10 Hours**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination. Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT – III **10 Hours**

Quality Control: Quality control test for containers, rubber closures and secondary packing 141 materials. 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

UNIT – IV **08 Hours**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT – V **07 Hours**

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, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management.

Learning Experience

The Quality Assurance (QA) course plays a crucial role in equipping students with the skills and knowledge necessary to ensure that products, services, and processes meet established standards of quality. By integrating this course into the curriculum, students can align their academic and career objectives with industry demands, enhancing their employability in various sectors such as manufacturing, software development, healthcare, and service industries.

Quality Assurance is an essential component of any professional programme that emphasizes the delivery of high-quality products and services. This course is vital as it teaches students how to identify, prevent, and correct quality issues, ensuring that organizations can meet customer expectations and regulatory requirements. QA also ties closely with continuous improvement, making it fundamental for any programme focused on operational excellence.

Textbooks

1. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
2. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
3. How to Practice GMP's – P P Sharma.
4. ISO 9000 and Total Quality Management – Sadhank G Ghosh

Reference Books

1. Quality Assurance Guide by organization of Pharmaceutical Products of India
2. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.

3. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
4. Good laboratory Practices – Marcel Deckker Series
5. ICH guidelines, ISO 9000 and 14000 guidelines

Suggested Readings

1. https://extranet.who.int/prequal/sites/default/files/document_files/QA_Pharmaceuticals-Vol2.pdf

Open Educational Resources (OER)

1.https://www.medipdf.in/2022/02/pharmaceutical-quality-assurance-notes-b-pharm.html

2.https://www.slideshare.net/Hardik_Mistry/quality-assurance-15029306

3.https://www.slideshare.net/VivekJain275/quality-assurance-and-quality-management-concepts

4.https://www.slideshare.net/snigdharanibehera/iso9000-iso14000-bpharmacy-6th-sempharmaceutical-quality-assurance-unitiii

5.https://www.slideshare.net/garginanda93/basic-concepts-of-qa-and-qc

6.https://www.ich.org/page/ich-guidelines

7.https://www.fda.gov/science-research/clinical-trials-and-human-subject-protection/ich-guidance-documents

8.https://copbela.org/downloads/2020/SELF%20LEARNING%20MATERIAL%20BPHARMA/semester%206/BP606T/MODULE%2001.pdf

9.https://www.slideshare.net/ShrutiBattinwar/complaints-quality-assurance

10.https://www.aptean.com/en-EU/insights/blog/how-quality-assurance-processes-play-a-crucial-role-in-complaint-handling

11. https://www.slideshare.net/snigdharanibehera/total-quality-management-tqm-definition-elements-philosophies.

12. https://www.slideshare.net/sainathkari/spartan-ppt.

13. https://www.eolss.net/sample-chapters/c13/E1-46A-05-14.pdf.

14. https://www.slideshare.net/Dhruvi50/organization-and-personnel-responsibilities.

15. https://safetyculture.com/topics/good-laboratory-practice-glp/.

16. https://www.slideshare.net/ShrutiBattinwar/complaints-quality-assurance.

17. https://www.slideshare.net/PrincyAgarwal6/pharmaceutical-calibration-qualification-and-validation-an-introduction.

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**
1	Sessional I & II	4 hr.	10
2	Continuous Mode - Attendance	-	2
3	Continuous Mode – Viva-Voce	-	3
4	End Term Examination	4 hr.	35
Total			**50**

BP607P	Medicinal Chemistry-III	L	T	P	C
Version	2	0	0	4	2
Category of Course	Core				
Total Contact Hours	60 hours				
Pre-Requisites/ Co-Requisites	Analytical Chemistry				

Course Perspective

The Medicinal Chemistry-III Practical course provides essential hands-on experience, complementing theoretical knowledge gained in lectures. This practical module focuses on the synthesis and analysis of pharmaceutical compounds, allowing students to apply key techniques such as reflux, distillation, and chromatography.

Course Outcomes

CO1. Understanding the synthesis of pharmaceutical compound.

CO2. Applying characterization of chemical products and pharmaceutical products.

CO3. Analysing the reaction mechanism involved during synthesis.

CO4. Evaluating reaction mechanism and develop problem-solving skill.

CO5. Creating pathways of green chemistry during synthesis.

Course Content:

S. No.	Experiment
1.	To perform synthesis of sulphanilamide and report its melting point and percentage yield.
2.	To perform synthesis of 7-hydroxy 4-methyl coumarin and report its melting point and percentage yield.
3.	To perform synthesis of chlorobutanol and report its melting point and percentage yield.
4.	To perform synthesis of triphenyl imidazole and report its melting point and percentage yield.
5.	To perform synthesis of tolbutamide and report its melting point and percentage yield.
6.	To perform synthesis of hexamine and report its melting point and percentage yield.
7.	To perform assay of isonicotinic acid hydrazide and determine its percent purity.
8.	To perform assay of chloroquine and determine its percent purity.
9.	To perform assay of metronidazole and determine its percent purity.
10.	To perform assay of dapsone and determine its percent purity.

11.	To perform assay of chlorpheniramine maleate and determine its percent purity.
12.	To perform assay of benzyl penicillin and determine its percent purity.
13.	To carry out preparation of medicinally important compounds by Microwave irradiation technique
14.	To draw chemical structures of compounds using chemdraw.
15.	To carry out determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software and performing drug likeliness screening (Lipinskies RO5)

Reference Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Mann and Saunders, Practical organic chemistry.

Textbooks:

1. Medicinal and pharmaceutical chemistry by Harkishan Singh.
2. Medicinal and pharmaceutical chemistry by V. algarsamy.

Open Education Resources (OER):

1. https://labmonk.com/category/medicinal-chemistry
2. https://www.youtube.com/watch?v=2h_DGWZ7lGc
3. https://www.scribd.com/document/557415720/assay-chloroquine
4. https://library.iitd.ac.in/pdf/ChemDraw20240521.pdf

Evaluation Scheme

Components	**Sessional I and II**	**Continuous Mode**	**End Term Exam**	**Total**
Weightage (%)	**10**	**5**	**35**	**50**

Semester VI					
BP 608 P	**Pharmacology-III**	**L**	**T**	**P**	**C**
Version	2.0	**-**	**-**	**4**	**2**
Category of Course	Practical				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Pharmacology I and II, Pathophysiology				

Course Perspective:

The Pharmacology-III course focuses on advanced experimental pharmacology, encompassing both theoretical knowledge and practical applications. The course is designed to provide students with hands-on experience in various pharmacological techniques, emphasizing dose calculation, drug activity assessment, and biostatistics.

Course Outcomes

CO1: Understanding the bioassays using pre -clinical experimentation

CO2: Applying the principles the bioassays using the ex vivo techniques

CO3: Analysing the bioassays parameters with different drug solution

CO4: Evaluating the bioassays using test solution with standard drugs

Course Content

4Hrs/Week

1. Dose calculation in pharmacological experiments

2. Antiallergic activity by mast cell stabilization assay

3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.

4. Study of effect of drugs on gastrointestinal motility

5. Effect of agonist and antagonists on guinea pig ileum

6. Estimation of serum biochemical parameters by using semi- autoanalyser

7. Effect of saline purgative on frog intestine

8. Insulin hypoglycemic effect in rabbit

9. Test for pyrogens (rabbit method)

10. Determination of acute oral toxicity (LD50) of a drug from a given data

11. Determination of acute skin irritation / corrosion of a test substance

12. Determination of acute eye irritation / corrosion of a test substance

13. Calculation of pharmacokinetic parameters from a given data

14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA)

15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon

Signed Rank test)

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software and video

Learning Experience

In-Depth Study of mechanism of action of drugs

Interdisciplinary Approach

Industry Relevance

Textbooks

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier

2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

3. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Suggested Readings

1. lnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
2. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
3. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert.

Open Educational Resources (OER)

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP503T_PGPC_UNIT_I.pdf

2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/

3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7398001/

4. Ex Pharm Software

Evaluation Scheme

S. No.	**Evaluation Component**	**Duration**	**Weightage (%)**
1	Sessional I & II	4 hr.	10
2	Continuous Mode - Attendance	-	2
3	Continuous Mode – viva- voce	-	3
4	End Term Examination	4 hr.	35
Total			**50**

Semester VI					
BP609P	**Herbal Drug Technology (Practical)**	**L**	**T**	**P**	**C**
Version	**1.0**	**0**	**0**	**4**	**2**
Category of Course	**Core**				
Total Contact Hours	**4 Hours/week**				
Pre-Requisites/ Co-Requisites	**Pharmacognosy & Phytochemistry-I Practical**				

Course Perspective

This course provides essential knowledge in herbal drug analysis and formulation, contributing to students' academic and professional development in pharmaceutical and natural product industries. Students will learn techniques such as phytochemical screening, evaluation of natural excipients, and incorporation of plant extracts into cosmetic and pharmaceutical products

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the preparation of Herbal cosmetics.

CO2: Applying techniques in the preparation of Herbal formulations.

CO3: Analyzing the extraction, isolation & characterization of herbal isolate.

CO4: Evaluation of the quality of raw material.

Course Content

1. To perform preliminary Phytochemical screening of crude drugs
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeias requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Learning Experience

The course will be conducted through interactive lectures, hands-on lab sessions, and group activities to promote experiential learning. Students will perform practical tasks such as phytochemical screening, alcohol content determination, and evaluation of natural excipients using modern lab equipment. Case studies will be used to relate these activities to real-world herbal drug development. Group projects will focus on the incorporation of extracts into formulations like creams and syrups, followed by evaluations per Pharmacopoeial standards. Assessments will include lab reports, group presentations, and periodic quizzes. The course in charge will provide ongoing feedback, and students are encouraged to seek additional support when needed. Collaborative activities like peer reviews will further enhance learning.

Textbooks

1. Pharmacognosy by Kokate, Purohit and Gokhale
2. Essential of Pharmacognosy by Dr.S.H.Ansari

3. Pharmacognosy & Phytochemistry by V.D.Rangari

4. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy

Suggested Readings

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber

Open Educational Resources (OER)

1. **https://ffar.usu.ac.id/images/Buku_Penuntun_Laboratorium/Practical-Guidebook-Pharmacology-and-Toxicology.pdf**
2. **https://www.cbspd.co.in/pharmacology-a-practical-manual-for-medical-students-as-per-the-latest-cbme-guidelines-competency-based-undergraduate-curriculum-for-the-indian-medical-graduate**
3. **https://www.studocu.com/in/document/rajiv-gandhi-proudyogiki-vishwavidyalaya/pharmacology-1/bp-408-p-pharmacology-i/16005893**

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Semester VII					
BP701T	Instrumental Methods of Analysis – Theory	**L**	**T**	**P**	**C**
Version:	**2.0**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45				
Pre-Requisites/ Co-Requisites	Pharmaceutical Analysis				

Course Perspective:

The knowledge gained from this course is essential for ensuring the accuracy and precision of sample testing, which is critical for quality control and regulatory compliance in various industries such as pharmaceutical, biotechnology, food, chemical etc. Through hands-on experience, participants will develop the competence to effectively apply advanced analytical methods in real-world scenarios, fostering critical thinking and scientific rigor in analysis of samples from diverse field.

Course Outcomes:

Upon completion of the course the learner will be able to:

CO 1: Understanding the basic concepts and principles of range of instrumental methods in analytical chemistry.

CO 2: Applying the basic concepts and principles of range of chromatographic techniques.

CO 3: Analysing instrumental analytical techniques for quantitative & qualitative analysis of organic and inorganic samples.

CO 4: Evaluating and presenting experimental data and drawing sound conclusions based on experimental evidence for the quantitative and qualitative estimation of samples.

Course Content

Unit No 1: Spectroscopic Techniques Part I **No. of Hours: 10**

- 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. Applications - Spectrophotometric titrations, Single component and multi component analysis
- Fluorimetry Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications.

Unit No 2: Spectroscopic Techniques Part II **No. of Hours: 10**

- IR spectroscopy Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister , Pyroelectric detector and applications
- Flame Photometry-Principle, interferences, instrumentation and applications
- Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications Nepheloturbidometry - Principle, instrumentation and applications.

Unit No 3: Chromatography Techniques Part I **No. of Hours: 10**

- Introduction to chromatography 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
- Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.

Unit No 4: Chromatography Techniques Part II **No. of Hours: 08**

- Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications
- High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

Unit No 5: Chromatography Techniques Part III **No. of Hours: 07**

- Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications
- Gel chromatography- Introduction, theory, instrumentation and applications
- Affinity chromatography- Introduction, theory, instrumentation and application.

Learning Experience: This course will be conducted through a blend of lectures, hands-on laboratory sessions during practical course, and interactive group work to provide a comprehensive learning experience. Instructional methods will include detailed lectures on spectroscopic and chromatographic techniques, reinforced by multimedia presentations and virtual lab simulations to illustrate complex concepts. Students will engage in hands-on experiments, such as spectrophotometric titrations and chromatography, to apply theoretical knowledge practically. Group activities, including case studies and collaborative problem-solving exercises, will enhance peer learning and teamwork skills. Assignments will involve real-world applications, challenging students to analyze data and draw meaningful conclusions.

To support learning, regular feedback through will be provided through assessments, quizzes, and one-on-one consultations. The course in charge will be available for additional guidance, encouraging students to seek help when needed. Collaborative learning will be emphasized, with opportunities for students to work together, exchange ideas, and conduct peer reviews, ensuring a participatory and engaging educational experience.

Textbooks

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma 5th ed
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Organic Chemistry by I. L. Finar Volume 1
5. Organic Chemistry by I. L. Finar Volume 2
6. Organic spectroscopy by William Kemp 3rd ed
7. Instrumental Methods of Chemical Analysis by Gurdeep Chatwal

Reference Books/Materials

1. Practical Pharmaceutical Chemistry by A.H. Beckett Volume 1
2. Practical Pharmaceutical Chemistry by A.H. Beckett Volume 2
3. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
4. Quantitative Analysis of Drugs by D. C. Garrett 3rd ed
5. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi 3rd ed
6. Spectrophotometric identification of Organic Compounds by Silverstein 8th ed

Open Educational Resources (OER)

1. Swayam course: Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries by Prof. Shashank Deep
2. Swayam course: Application of Spectroscopic Methods in Molecular Structure Determination by Prof. Sankararaman
3. Swayam course: Analytical Techniques by Dr. Moganty R. Rajeswari
4. Swayam course: Analytical Techniques In Biochemistry by Dr. Moganty R. Rajeswari

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		10	
2	Sessional I/II Examination (Written Examination)	90Minutes	15	
3	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

Semester VII					
BP 702 T	Industrial Pharmacy II	**L** **3**	**T 1**	**P** **0**	**C** **4**
Version	**2.0**				
Category of Course	Core course				
Total Contact Hours	45 Hours				
Pre-Requisites/ Co-Requisites	Industrial Pharmacy II				

Course Perspective

This course provides essential knowledge on translating pharmaceutical products from laboratory research to market-ready formulations. Students learn the processes of pilot plant scale-up, technology transfer, and regulatory requirements essential for commercialization. Emphasizing industry practices, the course equips students with skills to navigate the approval process and adhere to laws governing the pharmaceutical sector, preparing them to effectively contribute to product development and compliance.

Course Outcome

Upon completion of the course the learner will be able to:

CO1: Understanding the key steps in pilot plant scale-up and technology transfer processes for pharmaceutical products.

CO 2: Describing the regulatory and legal requirements that govern the pharmaceutical industry.

CO 3: Applying knowledge of technology transfer to simulate scenarios transitioning from lab to commercial scale.

CO 4: Evaluating the regulatory approval processes and their impact on pharmaceutical product commercialization.

Course Content

Unit No: 01 **No. of Hours -** 10

- **Pilot plant scale up techniques**: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology

Unit No: 02 **No. of Hours -** 10

- **Technology development and transfer:** WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues

Unit No: 03 **No. of Hours - 10**

- **Regulatory affairs**: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals
- **Regulatory requirements for drug approval:** Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application

(NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

Unit No: 04 **No. of Hours - 08**

- **Quality management systems: Quality management & Certifications:** Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

Unit No: 05 **No. of Hours - 07**

- I**ndian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority:** Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs

Learning Experience

- **Research Assignments**: Investigative assignments that encourage students to explore emerging technologies and their applications in the pharmaceutical industry

- **Case Studies**: Analysis of real-world pharmaceutical case studies to understand regulatory challenges, manufacturing issues, and quality assurance practices.

- **Project Work**: Collaborative projects focused on drug development, scale-up processes, and entrepreneurship, fostering teamwork and problem-solving skills.

- **Field Visits**: Tours of pharmaceutical manufacturing facilities to observe and understand industry practices and technologies.

Textbooks

- Industrial Pharmacy by N K Jain, Vallabh Prakashan

- Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.

Suggested Readings

- International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php

Open Educational Resources (OER)

1. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Sessional Examination (Written Examination)	1.5 Hour	20	
2	End Term Examination (Written Examination)	03 Hour	80	
Total			**100**	

SEMESTER VII					
BP703 T	Pharmacy Practice Theory	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**-**	**4**
Category of Course	Core				
Total Contact Hours	45				
Pre-Requisites/ Co-Requisites	Pharmacology				

Course Perspective

Pharmacy practice focuses on equipping students with the knowledge, skills, and competencies required to effectively manage medication therapy, provide patient care, and navigate the professional aspects of pharmacy.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1. Understanding the international standards for classification of hospitals, and drug distribution methods in a hospital

CO 2. Applying the different techniques used in hospital, pharmacy stores management and inventory control system

CO 3. Analysing drug monitoring therapy of patient through medication chart review and clinical review

CO 4. Evaluating pharmaceutical care services in respect to pharmacy practice

Course Content

Unit I: **10 Hours**

a)Hospital and it's 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.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drug reaction Classifications

Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting 149 drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: **10 Hours**

a) 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.

b) 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.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III: **10 Hours**

a)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.

b) Drug information services

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) Patient counselling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) 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.

f) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Unit IV **8 Hours**

a) Budget preparation and implementation

Budget preparation and implementation

b) 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. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

b) Over the counter (OTC) sales

Introduction and sale of over the counter, and Rational use of common over the counter medications.

Unit V **7 Hours**

a) Drug store management and inventory control

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

b) Investigational use of drugs

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

Learning Experience

Pharmacy practice experiences, such as Introductory Pharmacy Practice Experiences (IPPEs), help students develop the knowledge, skills, and attitudes needed to work as a pharmacist. These experiences can include:

Observation: Students observe pharmacists in different settings.

Direct participation: Students participate directly in pharmacy practice.

Project activities: Students work on projects as part of their pharmacy practice experience.

Shared learning: Students learn to work as a team through shared learning experiences.

Textbooks

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.

2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1 st ed. Chennai: Orient Longman Private Limited; 2004.

3. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger; 1986.

4. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications

Suggested Readings

1. A Text Book of Clinical Pharmacy Practice: Essential Concepts and Skills, G. Parthasarathi, Karin Nyfort-Hansen, Milap C. Nahata
2. Pharmacy Practice, Jennie Watson, Louise Siobhan Cogan

Open Educational Resources (OER)

1. https://www.carewellpharma.in/bpharmacy/notes/7th-sem/pharmacy-practice
2. https://pharmaedu.in/b-pharm-7th-semester-pharmacy-practice-notes-download/
3. https://lastbenchpharmacist.in/download-pharmacy-practice-b-pharm-semester-7-pdf-notes-for-free/

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/Extempore)		10	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		75	
	Total		100	

Semester VII					
BP704 T	**Novel Drug Delivery System**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**-**	**4**
Category of Course	Core Course				
Total Contact Hours	45 Hours				
Pre-Requisites/Co-Requisites					

Course Perspective:

This course on novel drug delivery systems provides a foundational understanding of advanced methods to optimize drug administration and efficacy. It focuses on overcoming the limitations of traditional dosage forms. It covers various controlled and sustained drug delivery systems which addresses different challenges and overcome physiological barriers. The course also delves into advancements in materials like biodegradable polymers. Students will gain practical knowledge in designing delivery systems and understanding emerging trends like personalized medicine in drug formulation.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the various techniques and methodology of various drug delivery systems and their techniques and methodology.

CO2: Applying different techniques to formulate novel drug delivery.

CO3: Analysing the various approaches to targeted drug delivery systems, including liposomes, niosomes, nanoparticles, and monoclonal antibodies, to determine their suitability for specific therapeutic uses.

CO4: Evaluating the formulation challenges and solutions for novel drug delivery.

Course Content

Unit I: **10 Hours** Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design-controlled release formulations based on diffusion, dissolution, and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations Polymers: Introduction, classification, properties, advantages, and application of polymers in formulation of controlled release drug delivery systems.

Unit-II **10 Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion /mucoadhesion, concepts, advantages, and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump.

Unit-III **10 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches.

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high-density systems, inflatable and gastro-adhesive systems and their applications

Naso pulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV **08 Hours** Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies, and their applications

Unit-V **07 Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts. Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications.

Learning Experience: The study of pharmaceutical novel drug delivery systems provides a comprehensive understanding of various advanced drug delivery techniques, including controlled, transdermal, mucosal, implantable, gastroretentive, nasopulmonary, ocular, and targeted drug delivery systems. This subject explores the principles behind each system, highlighting their unique advantages, limitations, and the selection criteria for appropriate drug candidates. It delves into the design approaches based on different mechanisms like diffusion, dissolution, and ion exchange, along with the role of polymers. Additionally, students learn about the practical applications and formulation considerations for enhancing drug efficacy and patient compliance, which are crucial for advancing therapeutic outcomes.

Textbooks

1. 1. Y W. Chien, Novel Drug Delivery Systems, 2 nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.

3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York.Chichester/Weinheim

4. Text Book of NDDS by Dr. Aijaz A. Sheikh *et al*.

5. Current Trends in NDDS by Dr. B. Arul *&et al*

Reference Books/Materials

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001)

2. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Suggested Readings

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

Open Educational Resources (OER)

1.https://www.slideshare.net/deepak956862/control-drug-delivery-system-114841494

2.https://www.slideshare.net/sampadatamhankar1/microencapsulation-237579862

3https://www.slideshare.net/radhipatel05/osmotic-drug-delivery-system

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Attendance/ Presentation/ Extempore)	-	10	
2	Sessional Examination (Written Examination)	60 Minutes	15	
3	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

Semester VII					
BP705P	Instrumental Methods of Analysis – Practical	**L**	**T**	**P**	**C**
Version:	**2.0**	**-**	**-**	**4**	**2**
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Pharmaceutical Analysis				

Course Perspective

The knowledge gained from this course is essential for ensuring the accuracy and precision of sample testing, which is critical for quality control and regulatory compliance in various industries such as pharmaceutical, biotechnology, food, chemical etc. Through hands-on experience, participants will develop competence to effectively apply advanced analytical methods in real-world scenarios, fostering critical thinking and scientific rigor in analysis of samples from diverse field.

Course Outcomes:

Upon completion of the course the learner will be able to:

CO 1: Demonstrate the differences between various types of instrumental analytical techniques used in chemical analysis in terms of basic principles, parts, functions and applications.

CO 2: Handle the analytical equipment's used for analytical and separation of organic and inorganic compounds.

CO 3: Perform experiments that showcase an understanding of the spectroscopic techniques and separation techniques used in pharmaceutical industries.

CO 4: Read, evaluate, and interpret numerical, chemical and general scientific information related to instrumental methods of chemical analysis.

CO 5: Interpret the various types of spectra obtained from spectroscopic techniques under study and identify organic and pharmaceutical molecules.

Course Content

List of Experiments

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5. Assay of paracetamol by UV- Spectrophotometry
6. Estimation of quinine sulfate by fluorimetry
7. Study of quenching of fluorescence
8. Determination of sodium by flame photometry
9. Determination of potassium by flame photometry
10. Determination of chlorides and sulphates by nepheloturbidometry
11. Separation of amino acids by paper chromatography
12. Separation of sugars by thin layer chromatography
13. Separation of plant pigments by column chromatography
14. Demonstration experiment on HPLC
15. Demonstration experiment on Gas Chromatography

Learning Experience: This course will be conducted through a blend of lectures, hands-on laboratory sessions, and interactive group work to provide a comprehensive learning experience. Instructional methods will include detailed lectures on spectroscopic and chromatographic techniques, reinforced by multimedia presentations and virtual lab simulations to illustrate complex concepts. Students will engage in hands-on experiments, such as spectrophotometric titrations and chromatography, to apply theoretical knowledge practically. Group activities, including case studies and collaborative problem-solving exercises, will enhance peer learning and teamwork skills. Assignments will involve real-world applications, challenging students to analyze data and draw meaningful conclusions.

To support learning, regular feedback through will be provided through assessments, quizzes, and one-on-one consultations. The course in charge will be available for additional guidance, encouraging students to seek help when needed. Collaborative learning will be emphasized, with opportunities for students to work together, exchange ideas, and conduct peer reviews, ensuring a participatory and engaging educational experience.

Text Books

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors

Reference Books/Materials

1. Practical Pharmaceutical Chemistry by A.H. Beckett Volume 1
2. Practical Pharmaceutical Chemistry by A.H. Beckett Volume 2
3. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
4. Quantitative Analysis of Drugs by D. C. Garrett
5. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
6. Spectrophotometric identification of Organic Compounds by Silverstein

Open Educational Resources (OER)

1. Swayam course: Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries by Prof. Shashank Deep
2. Swayam course: Application of Spectroscopic Methods in Molecular Structure Determination by Prof. Sankararaman
3. Swayam course: Analytical Techniques by Dr. Moganty R. Rajeswari
4. Swayam course: Analytical Techniques In Biochemistry by Dr. Moganty R. Rajeswari

Evaluation Scheme:

S. No.	Evaluation Component	Duration	Weightage (%)
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)		5
2	Sessional I/II Examination (Written Examination)	4 h	10
3	End Term Examination (Written Examination)	4 h	75
Total			**50**

BP-801T	BIOSTATISITCS AND RESEARCH METHODOLOGY	L	T	P	S	C
Version	2	3	1			4
Pre-requisites/Exposure	Mathematics					
Co-requisites	Ms-Excel and Any Statistical Software					

Course Perspective

Biostatistics and Research Methodology" is fundamental in pharmacy education, equipping students with essential skills for analyzing and interpreting data, which is critical in clinical research and pharmaceutical development. Biostatistics allows pharmacists to evaluate clinical trial results, ensuring that drugs are safe and effective, while also aiding in understanding epidemiology and public health.

COURSE OUTCOMES (COs)

CO1: Understanding fundamentals of biostatistics

CO2: Applying the Parametric and Non-Parametric models for developing relevant inferences on associated parameters.

CO3: Analyzing advanced level topics in statistical inference on testing of statistical hypotheses for both randomized and non-randomized tests.

CO4: Evaluating the appropriate experimental designs to related to experimental data.

SYLLABUS

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals example

Unit-II **10 Hours** Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference

Unit-III **10 Hours**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph 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

Unit-IV **8 Hours** Blocking and confounding system for Two-level factorials.

Regression modeling: Hypothesis testing in Simple and Multiple regression models Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB ® , DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V **7 Hours**

Design and Analysis of experiments:

Factorial Design: Definition, 2^2 , 2^3 design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Text Books

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. New York.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

Reference Books/Materials

1. Biostatistics-A Foundation for analysis in the health sciences by Wayne W. Daniel and Chad L.Cross.

Online Reference

1.https://www.slideshare.net/HarinathaReddyA/biostatistics-frequency-distribution

2. https://pharmacyinfoline.com/dispersion-range-standard-deviation/

3. https://mu.ac.in/wp-content/uploads/2020/12/Statistics-and-Probability.pdf

4.https://www.slideshare.net/RavinandanAPNandan/unit-2-regression-bsrmpdf

5. https://www.slideshare.net/NikhilGupta26/probability-14162261

6. https://www.britannica.com/science/probability-theory

Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Mode (Attendance /Assignment/ Teacher-Student Interaction)	-	10	
2	Written Examination (Sessional I and II)	60 Minutes	15	
3	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

SEMESTER VIII					
802T	**Social and Preventive Pharmacy**	**L**	**T**	**P**	**C**
Version	**2**	**3**	**1**	**0**	**4**
Category of Course	Core				
Total Contact Hours	45 Hours				
Pre-Requisites/ Co-Requisites	Pharmacology / Community Pharmacy				

Course Perspective

This course provides a critical understanding of public health and its relation to pharmacy, enhancing students' ability to contribute to healthcare initiatives. It prepares students for roles in public health, policy-making, and pharmaceutical care by emphasizing disease prevention and health promotion.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding of current issues related to health and pharmaceutical problems within the country and worldwide.

CO2: Applying various national and international health and disease control programmes.

CO3: Analysing a critical thinking approach based on the advancements in healthcare today.

CO4: Evaluating alternative ways of solving problems related to health and pharmaceutical issues.

Course Content

Unit I: 10 Hours

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.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

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

Hygiene and health: personal hygiene and health care; avoidable habits

Unit II: 10 Hours

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

Unit III: 10 Hours

National health programs, its objectives, functioning and outcome of the following:

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV: 08 Hours

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

Unit V: 07 Hours

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Learning Experience

Course Conduct:

The course will be conducted through interactive lectures, case studies, and group discussions, making the learning process experiential and participatory. Technology will be integrated via online resources, virtual simulations, and e-learning platforms to enhance understanding.

Methods of Instruction:

Instruction will include a mix of lectures, multimedia presentations, and real-world case studies to provide a comprehensive learning experience. Students will engage in hands-on learning through practical activities, group work, and community-based projects.

Activities and Assessments:

Students will participate in group assignments, peer reviews, and case studies to apply theoretical knowledge to practical scenarios. Assessments will include written exams, project reports, and presentations to evaluate their understanding and application of course material.

Support and Feedback:

The course instructor will provide regular feedback on assignments and projects, and be available for additional support as needed. Students are encouraged to collaborate in group activities and seek help from peers and instructors to reinforce learning.

Textbooks

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications

2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications

3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications

4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications

5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.

6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Suggested Readings

Open Educational Resources (OER)

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2274388/
2. http://sihfwrajasthan.com/Ppts/Full/Family%20Welfare%20Program%20%20Population%20Policy.pdf
3. https://main.mohfw.gov.in/sites/default/files/Chapter915.pdf
4. https://pubmed.ncbi.nlm.nih.gov/1819561/
5. https://vikaspedia.in/health/nrhm/national-health-programmes-1/national-tobacco-control-programme
6. https://dhs.assam.gov.in/schemes/national-tobacco-control-programme-0
7. http://nhp.gov.in/national-program-of-health-care-for-the-elderly-n_pg
8. https://main.mohfw.gov.in/major-programmes/other-national-health-programmes/national-programme-health-care-elderlynphce
9. https://www.ruralhealthinfo.org/topics/schools
10. https://www.slideshare.net/mnajeeb80/rural-urban-health
11. https://en.wikipedia.org/wiki/Health_education
12. https://www.thestudyprep.co.uk/page/?title=Personal%2C+Social%2C+Health+Education&pid=112
13. https://www.globeschool.org.uk/Learning/Personal-Social-and-Health-Education/

14. https://www.dettol.co.in/en/personal-hygiene/
15. https://www.medicalnewstoday.com/articles/personal-hygiene
16. https://www.solvhealth.com/health-a-z/good-hygiene
17. http://www.isrctn.com/ISRCTN43845142
18. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2886036/
19. https://www.medicinenet.com/cancer/article.htm
20. https://www.healthline.com/health/cancer

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Semester VIII					
BP 803E T	**Pharma Marketing Management**	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**	**0**	**4**
Category of Course	**Elective**				
Total Contact Hours	**45 Hours**				
Pre-Requisites/Co Requisites	**Industrial Pharmacy**				

Course Perspective

Contribution to Student Learning Goals: This course pharma marketing management plays a pivotal role in enhancing students' understanding of the pharmaceutical industry and its relationship with healthcare systems. It equips students with the critical skills needed to effectively market pharmaceutical products in a regulated and ethical environment. By learning about the product life cycle, pricing strategies, and promotional techniques, students will be prepared to contribute meaningfully to the business side of healthcare while maintaining a focus on patient well-being.

Course Outcomes

Upon completion of the course the learner will be able to:

CO1: Understanding the key concepts of pharmaceutical marketing and the regulatory environment governing the promotion and distribution of pharmaceutical products at both national and global levels.

CO2: Applying various marketing strategies and their application in the pharmaceutical industry, including product positioning, pricing, and promotion, while ensuring ethical marketing practices.

CO3: Analysing critical thinking to assess market **dynamics** and create data-driven marketing plans that address current challenges in the pharmaceutical industry, such as competition, regulatory changes, and consumer behavior.

CO4: Evaluating the effectiveness of different marketing approaches and strategies for pharmaceutical products by considering alternative solutions and optimizing market access to meet public health and business goals.

Course Content

10 Hours

Unit I

Marketing: Definition, general concepts and scope of marketing; Distinction between marketing &selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research. Unit II 10 Hours Product decision: Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit II **10 Hours**

Product decision: Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry

10 Hours

Unit III

Promotion: Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

10 Hours

Unit IV

Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

10 Hours

Unit V

Pricing: Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing: Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Learning Experience

Course Conduct: The course will be conducted through interactive lectures, marketing simulations, andcase-based learning, making the learning process dynamic and engaging. Students will have access to industry-specific online resources, such as pharma market reports, marketing tools.

Methods of Instruction: Instruction will include a blend of lectures, real-world case studies, and digital marketing platforms to provide a comprehensive learning experience.

Activities and Assessments: Students will participate in group projects, case studies, and market simulations that challenge them to apply marketing principles in the pharmaceutical context. Group assignments will involve designing marketing strategies for new drug launches or analyzing existing pharma products.

Support and Feedback: The course instructor will provide regular feedback on assignments, projects, and presentations, ensuring continuous improvement in understanding.

Textbooks

1. Philip Kotler and Kevin Lane Keller: Marketing Management
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management.
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, Indian Context,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

Reference Books/Materials

1. Pharma Marketing Management by Dr. Ritu Kataria, Thakur publication private limited.
2. Pharma marketing management by Dr. Rupesh K. Gautam, Dr. Ankit Jain, Dr. Shailendra Bhatt

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

Semester VIII					
BP 805 ET	Pharmacovigilance Theory	**L**	**T**	**P**	**C**
Version	**2.0**	**3**	**1**		**4**
Category of Course	Elective				
Total Contact Hours	45				
Pre-Requisites/ Co-Requisites	Pharmacology				

Course Perspective

Pharmacovigilance- a Clinical Perspective course explores the essential elements of monitoring, assessing, and preventing adverse effects of medications in a clinical setting. Participants will gain insights into the importance of pharmacovigilance in ensuring patient safety and public health, as well as the regulatory frameworks governing drug safety monitoring

Course Outcomes

Upon completion of the course the learner will be able to:

CO1 Understanding process of drug discovery and development Creating

CO 2 Applying the regulatory authorities and agencies methods to follow the pharmacovigilance

CO 3 Analyzing the pharmacovigilance outcomes

CO 4 Evaluating the pharmacovigilance techniques and outcome data

Course Content

Unit I: **10 Hours**

Hospital and it's 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. b) Hospital pharmacy and its organization Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists. c) Adverse drug reaction Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting 149 drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management. d) Community Pharmacy Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: **10 Hours**

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. b) 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. c) Therapeutic drug monitoring Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring. d) Medication adherence Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence. e) Patient medication history interview Need for the patient medication history interview, medication interview forms. f) Community pharmacy management Financial, materials, staff, and infrastructure requirements.

Unit III: **10 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. b) Drug information services 150 Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. c) Patient counseling Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist d) 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. e) Prescribed medication order and communication skills Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Unit IV **8 Hours**

Budget preparation and implementation Budget preparation and implementation b) 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. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. c) Over the counter (OTC) sales Introduction and sale of over the counter, and Rational use of common over the counter medications.

Unit V **7 Hours**

Drug store management and inventory control Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure b) Investigational use of drugs 151 Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. c) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis

Text Books

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.

2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1 st ed. Chennai: Orient Longman Private Limited; 2004.

3. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger; 1986.

4. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.

Reference Books

1. Scott LT. Basic skills in interpreting laboratory data, 4thed. American Society of Health System Pharmacists Inc; 2009.

2. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributers; 2008.

Online Reference

1. . https://pharmaedu.in/b-pharm-7th-semester-pharmacy-practice-notes-download/
2. https://lastbenchpharmacist.in/download-pharmacy-practice-b-pharm-semester-7-pdf-notes-for-free/

Learning Experience

The learning experience in pharmacovigilance can be both rigorous and rewarding, as it involves mastering a range of skills and knowledge areas critical to drug safety. Learning to use pharmacovigilance databases like VigiBase or FDA Adverse Event Reporting System (FAERS) for data entry, retrieval, and analysis.Gaining practical experience in detecting and analyzing safety signals using statistical tools and methodologies.

Evaluation Scheme (Please refer to Notice Ref No: KRMU/CoE/Even/2023-24/018 dated 10 May 2025)

	Evaluation component	Duration	Weightage (%)	Date
1	** Continuous assessment (Quiz/Assignment/Presentation/ Extempore)		10	
2	Sessional I/II Examination (Written Examination)		15	
3	End Term Examination (Written Examination)		75	
	Total		100	

Semester VIII					
BP809ET	**COSMETIC SCIENCE**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Category of Course	ELECTIVE				
Total Contact Hours	45				
Pre-Requisites/ Co-Requisites	Pharmaceutics-I, Industrial Pharmacy-I				

Course Perspective

This course in Cosmetic Sciences focuses on the scientific principles and applications related to the formulation and development of cosmetic products.

Upon completion of the course the learner will be able to:

CO1: Understanding the chemistry of cosmetic formulations.

CO2: Apply dermatological knowledge to product development

CO3: Analysing product safety and efficacy of the dermatological products

CO4: Evaluate product safety and efficacy of the dermatological products

Course Content

UNIT I **(Lectures- 10)**

Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums.

UNIT II **(Lectures- 10)**

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye.

Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **(Lectures- 10)**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric

Hair care: Henna and amla.

Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin- cream and toothpaste.

UNIT IV **(Lectures- 8)**

Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps,and syndet bars. Evolution and skin benfits.

UNIT V **(Lectures-7)**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

Learning Experience (describe how the course will be conducted and made experiential and participatory. Include the methods of instruction, use of technology, and the types of activities like case studies, hands-on learning, group work, assignments, and classroom and outside classroom experiences, and assessments that students will engage in to achieve the learning outcomes. Besides mentioning the support and feedback that shall be given, for eg course in charge will be available for additional support and feedback, students are encouraged to seek help as needed. Students will have opportunities to collaborate and support each other through group activities and peer reviews).

Textbooks

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4 th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers

4) Cosmetic and Toiletries recent suppliers' catalogue.

5) CTFA directory.

Suggested Readings

1. Harry's Cosmeticology. 8 th edition.
2. Poucher's perfume cosmetics and Soaps, 10th edition.
3. Cosmetics - Formulation, Manufacture and quality control, PP.Sharma,4 th edition
4. Handbook of cosmetic science and Technology A.O.Barel, M.Paye and H.I. Maibach. 3 rd edition

Open Educational Resources (OER)

1. **https://onlinelibrary.wiley.com/journal/14682494**
2. **https://onlinelibrary.wiley.com/page/journal/14682494/homepage/forauthors.html**
3. **https://library.scconline.org/journal-of-cosmetic-science/**
4. **http://www.cosmeticsciencetechnology.com/subscribe.php**

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Continuous Mode – Attendance/ Assignment/ Student-Teacher interaction	-	10	
2	Sessional I & II	60 minutes	15	
3	End Term Examination	180 minutes	75	
Total			**100**	