

PROGRAM CURRICULUM
of
School of Pharmaceutical Sciences
(B.Pharm.)

(Program Code:)

[Applicable w.e.f. Academic Year 2025-26]



JIGYASA UNIVERSITY

Formerly Himgiri Zee University, Dehradun

(Estd. Under Uttaranchal State Act. No. 17, 2003. Approved by UGC Under Sec. 2(f))

Post Office Selaqui, Chakrata Road, Dehradun, Uttarakhand, 248011

Vision of University

We provide the environment to ignite, nurture, and unleash your potential and talent

Mission Statement

1. Progressive educational proficiencies that stimulate holistic development.
2. Enhancing experiential learning through endorsing an inclusive mindset.
3. Advancing research, nurturing innovations, and catalyzing entrepreneurship.
4. Cultivation of leadership qualities with a strong sense of values and ethics.

Vision of School of Pharmaceutical Sciences (SPS)

To become a global leader in pharmacy education, clinical research, and service, committed towards providing a transformative learning experience in a collaborative and diverse environment focused on improving the health and well-being of the communities.

Mission Statements of SPS

- **M1.** To improve the well-being and quality of life of individuals and communities by educating students.
- **M2.** To prepare students to become pharmacists and pharmaceutical scientists who will be leaders in the pharmacy profession.
- **M3.** Research in the pharmaceutical & clinical sciences and its translation into health care

About the Program

A. Introduction:

The Bachelor of Pharmacy (B.Pharm) program at the School of Pharmaceutical Sciences, Jigyasa University (Formerly Himgiri ZEE University), is a four-year undergraduate program developed in accordance with the guidelines of the Pharmacy Council of India (PCI). The curriculum has been structured to provide students with a thorough understanding of pharmaceutical sciences, including human anatomy, drug dosage, pharmacological actions, formulation of active ingredients, and the maintenance of drug quality during storage.

The program places strong emphasis on practical training, patient counseling, and the development of industry-relevant skills, ensuring that students are prepared for holistic pharmaceutical care in professional practice settings. In addition, the curriculum encourages critical thinking, multidisciplinary learning, and lifelong learning to equip students with the knowledge, skills, and adaptability required to meet the evolving demands of the healthcare and pharmaceutical sectors.

Through this program, our objective is to develop competent pharmacy graduates who are well-prepared to contribute effectively to patient care, research, and the pharmaceutical industry.

B. Credit Framework of 4 Year Bachelor's Degree in Pharmaceutical Sciences (Session 2025-26)

Semester / Year	Core Courses	Major Discipline Courses (MDC) (4c)	Discipline Specific Elective Courses		Multidisciplinary Courses MLC (3c)	Ability Enhancement Courses AEC (3c)	Skill Enhancement Courses SEC (3c)	Value Added Courses VAC (2c)	Capstone Project & Research Project CAP (4c) & REP (12c)	Total Credits	No. of Courses/ Year
			DSE (Major) (3c)	DSE (Minor) (3c)							
I	No. of Courses	8			2		2			12	27/29/ 30
	Course Credits	24			3		3			29^{\$}/ 30[#]	
II	No. of Courses	7				3				10	29
	Course Credits	22				7				29*	
III	No. of Courses	8								8	24
	Course Credits	24								24	
IV	No. of Courses	9								9	28
	Course Credits	28								28	
V	No. of Courses	8								8	26
	Course Credits	26								26	
VI	No. of Courses	9								9	30
	Course Credits	30								30	
VI I	No. of Courses	5				1				6	24
	Course Credits	18				6				24	
VI II	No. of Courses	2			10				1	13	22
	Course Credits	8			8				6	22	
No. of Courses		56			12	4	2		1	75	75
Course Credits		180			11	13	3		6	213	210/21 2/213[@]

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

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

*Lateral entry students shall transfer 52 credits from the D.Pharm program and complete 7 additional remedial credits — Communication Skills (3 credits) and Computer Applications in Pharmacy (4 credits) — to attain the required 59 credits equivalent to the first and second semesters.

[@] Extracurricular/ Co curricular activities Credit - 01 **Note** - College Principals will award and submit credit points for extracurricular/co-curricular activities to the University, based on criteria set by the colleges.

C. Academic Bank of Credits (ABC):

In accordance with the National Education Policy (NEP) 2020, the Bachelor of Pharmacy (B.Pharm) programme under the School of Pharmaceutical Sciences, Jigyasa University, Dehradun, follows the Academic Bank of Credits (ABC) framework to ensure flexibility and academic mobility.

All B.Pharm students must register on the ABC portal. Credits earned during the course, as per PCI-prescribed curriculum and NHEQF Level 6 outcomes, will be digitally stored in the ABC account.

D. Curriculum Framework:

The B.Pharm curriculum framework is designed in accordance with the guidelines of the Pharmacy Council of India (PCI) and emphasizes a comprehensive approach to undergraduate pharmaceutical education. The courses are broadly classified as follows: : Major Core Courses (MCC), Major Discipline Courses (MDC), Discipline Specific Elective Courses- Major& Minor(DSE), Multidisciplinary Courses (MLC), Skill Enhancement Courses (SEC), Ability Enhancement Courses (AEC), Value-Added Courses (VAC), Capstone Projects (CAP), and Research Projects (REP)

This structured framework ensures that students acquire in-depth theoretical knowledge, practical skills, and research competencies essential for professional pharmacy practice, industry readiness, and holistic pharmaceutical care. It also promotes critical thinking, multidisciplinary exposure, and lifelong learning, preparing graduates to meet the evolving challenges of the healthcare and pharmaceutical sectors.

I. Major Core Courses (MCC):

Major Courses (MCC) encompass a comprehensive range of subjects designed to provide students with a strong foundation in pharmaceutical sciences. These courses are structured to enhance students' analytical thinking, problem-solving abilities, practical skills, and professional competence. The curriculum integrates key areas such as human anatomy and physiology, pharmacology, pharmaceuticals, pharmaceutical chemistry, pharmacognosy, and pharmacotherapeutics to develop well-rounded pharmacy professionals.

The MCC includes courses such as ****Human Anatomy & Physiology, Pharmaceutical Chemistry, Pharmacology, Pharmaceuticals, and Pharmaceutical Analysis****, which provide insights into drug mechanisms, chemical properties, formulation techniques, and quality control measures. Courses like

Pharmacognosy and Pharmacotherapeutics emphasize the study of natural and synthetic drugs, their therapeutic applications, and patient-centered care. Advanced courses such as Industrial Pharmacy, Regulatory Affairs, and Research Methodology prepare students for industry challenges, regulatory compliance, and academic or applied research.

II. Major Discipline Courses (MDC)

Major Discipline Courses (MDC) encompass a comprehensive range of subjects designed to provide students with a strong foundation in pharmaceutical sciences. These courses are structured to enhance students' analytical thinking, problem-solving abilities, practical skills, and professional competence. The curriculum integrates key areas such as human anatomy and physiology, pharmacology, pharmaceutics, pharmaceutical chemistry, pharmacognosy, and pharmacotherapeutics to develop well-rounded pharmacy professionals.

The PCC includes courses such as Human Anatomy & Physiology, Pharmaceutical Chemistry, Pharmacology, Pharmaceutics, and Pharmaceutical Analysis, which provide insights into human body functions, drug composition, mechanisms of drug action, formulation techniques, and quality control. Courses like Pharmacognosy and Pharmacotherapeutics emphasize the study of natural and synthetic drugs, their therapeutic applications, and patient-centered care.

Furthermore, Pharmacy Practice, Clinical Pharmacy, and Community Pharmacy equip students with essential skills in patient counseling, medication management, and safe dispensing. Courses such as Industrial Pharmacy, Regulatory Affairs, and Research Methodology prepare learners to address industry challenges, regulatory compliance, and academic or applied research. Advanced topics like Biopharmaceutics & Pharmacokinetics, Toxicology, and Pharmaceutical Formulation Design enhance students' ability to analyze, innovate, and apply pharmaceutical knowledge in both clinical and industrial settings.

III. Discipline Specific Elective Courses – Major & Minor (DSE)

In line with the National Education Policy (NEP) 2020, the B.Pharm program offers advanced specialization options that enable students to align their academic pathway with industry requirements and career aspirations. These specializations include Pharmaceutical Analysis, Pharmacology, Pharmaceutics, Clinical Pharmacy, Herbal Drug Technology, Regulatory Affairs, and Industrial Pharmacy. Each specialization is designed to provide in-depth theoretical knowledge,

practical exposure, and hands-on training in the respective domain, enabling students to develop domain-specific competencies and become industry-ready professionals.

The NEP emphasizes flexibility, multidisciplinary learning, and skill enhancement, and these specialization tracks ensure that students gain both conceptual understanding and applied proficiency. By selecting a focused area, students can tailor their learning pathway to meet the evolving demands of the pharmaceutical and healthcare sectors. These specialization modules are integrated into the later semesters of the B.Pharm program, ensuring that students first acquire a strong foundation in core pharmaceutical sciences before advancing into expert-level study.

IV. Multidisciplinary Courses (MLC)

Multidisciplinary Courses (MLC) in the B.Pharm program are designed to integrate knowledge from various academic and scientific disciplines, offering students a well-rounded understanding of healthcare, pharmaceutical sciences, and related fields. These courses extend beyond core pharmacy subjects to explore how interdisciplinary knowledge contributes to effective problem-solving, innovation, and decision-making in pharmaceutical practice. By incorporating diverse perspectives, these courses enrich the learning experience and prepare students to address the complexities of the modern healthcare and pharmaceutical sectors.

The curriculum promotes adaptability, critical thinking, and ethical responsibility as essential qualities for competent pharmacy professionals.

V. Skill Enhancement Courses (SEC)

Skill Enhancement Courses (SECs) in the B.Pharm program play a vital role in equipping students with practical, professional, and industry-relevant competencies that extend beyond the core pharmaceutical curriculum. These courses are designed to develop both technical and analytical skills, enabling students to navigate today's technology-driven healthcare and pharmaceutical environment. By emphasizing real-world applications, SECs empower students with hands-on, job-oriented, and transferable skills essential for professional practice.

The curriculum includes five impactful courses:

1. Pharmacy Practice Lab – introduces students to essential laboratory and clinical pharmacy techniques, including drug dispensing, compounding, and patient counseling.
2. Analytical Techniques in Pharmacy – focuses on modern methods for analyzing drug formulations, quality control, and validation of laboratory results.

3. Clinical Skills – equips students with practical knowledge for patient care, medication management, and therapeutic monitoring.
4. Quality Assurance and Regulatory Compliance – provides hands-on experience in ensuring adherence to pharmaceutical quality standards and regulatory requirements.
5. Digital Tools in Pharmacy – prepares students to use digital technologies and software applications relevant to modern pharmaceutical practice.

VI. Ability Enhancement Courses (AEC)

While PCI covers generic professional skills (communication, ethics, regulatory awareness) implicitly, this category formalises it — enabling courses in professional communication, ethical practice, data analysis, and reasoning.

VII. Value-Added Courses (VAC)

This category is not part of the university marksheet, but is offered as a supplementary certificate. Students receive a certificate upon successful completion of the module, which highlights their skill development and readiness for industry, research, and professional practice. It is retained for supplementary modules such as **Entrepreneurship, Intellectual Property in Pharmacy, and Digital Tools etc. in Pharma

VIII. Capstone Project (CAP):

The Capstone Project (CAP) in the B.Pharm program is designed to provide students with an opportunity to integrate knowledge and skills acquired throughout the course and apply them to real-world pharmaceutical problems. It serves as a culmination of learning, emphasizing critical thinking, problem-solving, research aptitude, and professional competence.

Students undertake projects in areas such as drug formulation, industrial pharmacy, clinical pharmacy, pharmacovigilance, herbal drug technology, or pharmaceutical research. The CAP requires students to plan, execute, and present a comprehensive project under faculty supervision, demonstrating their ability to analyze data, interpret results, and propose practical solutions.

The project is structured to encourage independent learning, innovation, and interdisciplinary application, bridging theoretical knowledge with practical execution. Successful completion of the Capstone Project not only strengthens students' professional skills but also prepares them for advanced studies, industry roles, and research-oriented careers in pharmacy.

IX. Research Project (REP):

Although PCI emphasises project work, the term “research project” is not separately highlighted. We retain this category to emphasise students’ engagement in research-oriented work (laboratory or clinical) beyond standard project work.

Constitution of Courses in B.Pharm. Program

Matrix Course Category Name	Course Category Code	Number of Courses	Credits	Total Course Credits
Core Course	CORE	34	4	136
Core Course	CORE	22	2	44
Skill Enhancement Courses	SEC	1	2	2
Skill Enhancement Courses	SEC	2	1	2
Multidisciplinary Courses	MLC	1	2	2
Ability Enhancement Courses	AEC	1	6	6
Ability Enhancement Courses	AEC	2	3	6
Ability Enhancement Courses	AEC	1	1	1
Elective Courses	ELE	2	4	8
Capstone Project	CAP	1	6	6
TOTAL		66		213

Types of Courses (Non-Credit)

Category Name	Number of Courses	Total Number of Course
SEC	Soft Skills	06
AC	Audit Courses	10

E. Graduate Attributes (GA):

The Graduate Attributes (GAs) underpinning the Bachelor of Pharmacy (B.Pharm) programme have been developed in alignment with the National Education Policy (NEP) 2020, Pharmacy Council of India (PCI) guidelines. These attributes are further harmonized with the Pharmacy Council of India (PCI) – Education Regulations to reflect the professional, ethical, and scientific competencies expected of pharmacy graduates.

The B.Pharm curriculum is structured to ensure that students acquire the essential knowledge, technical skills, professional values, and lifelong learning capabilities required for safe, effective, and ethical practice in the pharmaceutical and healthcare sectors. The Program Educational Objectives (PEOs) and Program Outcomes (POs) are thus derived from these Graduate Attributes, ensuring full compliance with PCI and national quality assurance standards.

F. Program Educational Objectives (PEOs)- (B. Pharmacy)

PEO 1: To produce Pharmacy graduates with vital base concepts and high technical competence in Pharmaceutical Sciences.

PEO 2: To bestow students with well defined understanding in the various fields of Pharmacy viz., pharmaceuticals, pharmaceutical chemistry, pharmacology and pharmacognosy according to the requirement of pharmaceutical industries, community and Hospital Pharmacy.

PEO 3: Promote research in various fields of Pharmaceutical Sciences and implement the knowledge in formulating best suitable medicines for the society

PEO 4: Develop a sense of teamwork and awareness amongst students towards the importance of interdisciplinary approach for developing attributes ++++for solving complex problems in the area of Pharmaceutical Sciences.

PEO 5: Encourage the students to participate in life-long learning process for a highly productive career and to relate the concepts of Pharmaceutical Sciences towards serving the cause of the society.

G. Program Outcomes (POs) - (B. Pharmacy)

PO	Outcome
PO1	Pharmacy knowledge: Illustrate knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.
PO2	Problem analysis: State & Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Recognize , analyze information systematically and shall make defensible decisions.
PO3	Development of solutions: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
PO4	Conduct investigations of complex problems: Use research-based knowledge including developing experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Choose and Interpret appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations
PO6	The Pharmacist and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice
PO7	Environment and sustainability: Examine the impact of the professional pharmacy solutions in societal and environmental contexts, and Appraise the knowledge and need for sustainable development.
PO8	Pharmaceutical Ethics: Honor personal values and defend ethical principles in professional and social contexts. Develop behavior that recognizes cultural and personal variability in values, communication and lifestyles. Generate ethical frameworks; Justify ethical principles while making decisions and take responsibility for the outcomes associated with the decisions
PO9	Individual and team work: Plan effectively as an individual, and as a member or leader in teams, and gain multidisciplinary knowledge through innovative projects, industrial training.
PO10	Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to Interpret and write effective reports, make effective presentations and documentation, and give and receive clear

	instructions.
PO11	Project management and finance: Acquire knowledge and understanding of Pharmacy and management principles and apply these to one's own work, as a member and leader in a team. Formulate projects in multi disciplinary environments.
PO12	Life-long learning: Estimate the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-access and interpret feedback effectively from others to predict learning needs and to satisfy these needs on an ongoing basis.

H. Mapping of PEOs & POs in B. Pharm.

PEO – PO Attainment Matrix

PO→ PEO ↓	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO-1	3	2	2	1	2							
PEO-2	3	3	2	2	3	2	1	2		1	1	1
PEO-3	2	2	3	3	2	1	2	3			2	2
PEO-4	1	2	2	2	2	2	2	2	3	2	2	1
PEO-5	1	2	2	1	2	2	2	3	2	2	2	3

Note: In alignment with Outcome-Based Education (OBE) principles, the mapping of Program Educational Objectives (PEOs) to Program Outcomes (POs) is presented using a **quantitative scale (1–3)**, where:

- 1 indicates a low level of contribution
- 2 indicates a moderate level of contribution
- 3 indicates a high level of contribution

This mapping ensures that each PEO is **progressively achieved through the attainment of relevant POs**, thereby providing a structured and measurable approach to evaluating the effectiveness of the program in delivering its long-term educational goals.

I. Pedagogy, Andragogy, and Unique practices adopted:

Pedagogy refers to the art and science of teaching, particularly in academic and professional domains. In the B.Pharm program, the institute adopts a multifaceted and dynamic teaching approach in line with the Pharmacy Council of India (PCI) syllabus requirements, ensuring both theoretical understanding and practical competence.

Alongside traditional lecture-based instruction, students are engaged through experiential and active learning methods, including:

- Laboratory practicals and experiments- to develop hands-on skills in pharmaceuticals, pharmacology, pharmaceutical chemistry, and drug analysis.
- Case studies and problem-solving exercises to enhance clinical reasoning, dosage calculations, and decision-making in real-world pharmacy practice.
- Field visits and community pharmacy exposure- to understand patient care, drug distribution, and public health aspects.
- Group discussions and seminar presentations- to foster communication skills, teamwork, and critical thinking.
- Project-based learning- such as Capstone and Research Projects to integrate knowledge across disciplines, encourage scientific inquiry, and develop research aptitude.

These pedagogical methods are aligned with PCI mandates for B.Pharm programs, which emphasize the integration of theory, practical skills, and professional training. By adopting a combination of lectures, laboratory work, interactive sessions, and research-oriented activities, the pedagogy ensures that students gain a holistic understanding of pharmaceutical sciences, are able to apply knowledge in professional settings, and develop critical and analytical skills required for industry, research, and patient-centered practice

1. Orientation and Bridge Program:

At the commencement of the B.Pharm program, the School of Pharmaceutical Sciences will organize a comprehensive Orientation Program to welcome and guide newly enrolled students. The program aims to familiarize students with academic expectations, institutional values, professional responsibilities, and available support systems, thereby laying a strong foundation for their journey in pharmaceutical education.

The Orientation Program is a crucial step in easing students into university and professional life. It familiarizes students with the campus environment, faculty members, academic policies, laboratories,

library resources, and clinical facilities. Spanning approximately one week, the program fosters connections among peers, faculty, and support staff, creating a sense of belonging and community. It also ensures that students understand institutional rules, expectations, and resources, enabling a smooth and confident transition into the B.Pharm program.

In alignment with the Pharmacy Council of India (PCI) syllabus and the objectives of modern higher education, the Orientation Program is structured to provide holistic development, academic readiness, and professional growth. The key components include:

- Introduction to College and Professional Life: Helping students adjust to the academic, laboratory, and clinical environments of pharmaceutical education.
- Integration with University Culture: Building familiarity with the social, academic, and ethical framework of the institution.
- Faculty and Peer Interaction: Facilitating meaningful connections between students, faculty, and mentors to enhance engagement and support.
- Linkages with Society and Environment: Understanding the role of pharmacy in public health, sustainability, and community development.
- Philosophy of Pharmaceutical Education & Pedagogy: Introducing students to the values, goals, and teaching methodologies emphasized by PCI and modern pharmacy education.
- Academic Foundation and Bridge Courses: Bridging gaps in subject knowledge such as basic chemistry, biology, mathematics, and computer literacy to ensure academic preparedness.
- Personality Development and Professional Skills: Enhancing leadership, communication, teamwork, and emotional intelligence necessary for professional practice.
- Information Technology and Digital Skills: Providing essential digital literacy for academic success, research, documentation, and future employability in pharmaceutical and healthcare system.

This Orientation Program ensures that students enter the B.Pharm program with confidence, clarity, and readiness to meet the academic, practical, and professional challenges of their degree.

2. Experiential and Holistic Learning Approach:

To foster experiential learning beyond conventional classroom instruction, the B.Pharm program integrates a variety of participatory and applied pedagogical approaches. These methodologies are

designed to reinforce theoretical knowledge with practical application, enhance critical thinking, and develop professional competencies in alignment with the Pharmacy Council of India (PCI) syllabus. Students are encouraged to actively participate in School Clubs and Professional Development Forums, including:

- VIBGYOR Club – promoting creativity, cultural engagement, and holistic learning.
- Young Leaders' Club – enhancing leadership, teamwork, and communication skills.

The program employs a wide range of interactive and applied teaching–learning methods, including:

- Case-based Discussions: Applying theoretical concepts to real-world pharmaceutical and clinical scenarios.
- Role-plays, Group Assignments, and Presentations: Developing teamwork, communication, and problem-solving skills essential for professional pharmacy practice.
- Video-assisted Learning Sessions: Facilitating visual understanding of complex pharmaceutical processes, laboratory techniques, and clinical procedures.
- Field Assignments, Live Industry Projects, and Industrial Visits: Providing hands-on exposure to pharmaceutical manufacturing, research labs, hospitals, and community pharmacies.
- Expert-led Interactive Sessions: Enabling knowledge transfer from industry professionals, researchers, and clinicians.
- Co-curricular and Student Development Initiatives: Encouraging holistic growth through participation in seminars, workshops, competitions, and outreach programs.
- Mentorship Programs: Offering guidance for academic planning, career choices, and professional development.
- Workshops and Seminars: Strengthening practical skills, research aptitude, and awareness of current trends in pharmaceutical sciences.

These experiential and participatory pedagogies ensure that B.Pharm students gain not only strong conceptual knowledge but also the practical skills, ethical understanding, and professional competencies required to excel in the pharmaceutical industry, clinical practice, and research domains, fully aligning with PCI recommendations for undergraduate pharmacy education.

3. Career Counseling:

Career development is a continuous process that helps students understand themselves, explore various career options, and make informed educational and professional decisions. It goes beyond choosing a major or a job after graduation, focusing on long-term personal growth, skill enhancement, and aligning one's interests and values with suitable career paths for a fulfilling and successful future. Training – Internship – Placement Services (TIPS) Cell of the University provides support to shape the students for a brighter future. The TIPS majorly helps students by:

- *Industry – Academia Interactions*
- *Industrial Visits*
- *Career Counseling*
- *Training, Live Projects, and Internships*
- *Mock Interviews*
- *On / Off-Campus placement drives*

4. Library and E – Learning Access:

Course faculty actively encourage B.Pharm students to make regular and purposeful use of the University Library, guiding them to effectively utilize its extensive collection of physical books, journals, reference materials, and digital resources. These resources support academic learning, subject-specific research, laboratory work, and the overall enhancement of pharmaceutical knowledge.

In addition, students have access to a wide range of e-learning resources through their individual logins on the University's ERP and digital learning platforms. This facilitates continuous learning beyond classroom instruction, enabling students to engage in self-directed study, online research, simulation exercises, and virtual laboratory learning.

5. Massive Open Online Courses:

Before the commencement of each semester, a list of available MOOCs from platforms such as SWAYAM/NPTEL will be prepared by the Program Coordinators in consultation with the Dean of the School / Head of Department (HOD).

Students will enroll in the selected MOOC through the respective platform, and credit transfer will be applicable as per the University norms upon successful completion.

J. Question Paper and Assessment Tools

General Note on Assessment and Evaluation

Our University follows a *Continuous Evaluation System* that ensures students are assessed consistently and fairly throughout the semester. This system includes two main components: *Internal Assessments*, *Sessional Examinations*, and *End-Term Examinations*.

- As part of Internal Assessments, faculty members may adopt a variety of tools such as Surprise Quizzes, Assignments (Group or individual assignments, case study presentations and discussions, role plays, group discussions), and other interactive evaluation methods. These are designed to assess not just subject knowledge but also communication, collaboration, and critical thinking skills. The specific tools and weightage for each course will be clearly mentioned in the Course Syllabus and Assessment Scheme, which is shared at the beginning of the semester.
- All assessments across programs are conducted as per the guidelines outlined in the Examination Manual (EM) issued by the Controller of Examinations (CoE). This ensures consistency, fairness, and academic integrity in both theory and practical examinations.
- Course faculty are responsible for preparing question papers for internal, sessional, and end-term exams in line with the EM. Questions are developed using the Bloom's Taxonomy (BT) framework, which covers a range of learning levels—from basic understanding to advanced application and analysis.
- Each question is aligned with specific Course Outcomes (COs) to ensure that assessments are outcome-based. During evaluation, faculty will mark responses CO-wise, and this will be reflected in the answer sheet's marks column. This approach helps both faculty and students understand which learning outcomes have been achieved and where further improvement is needed.

This structured and student-centric assessment system encourages continuous learning and academic growth, while supporting the goals of Outcome-Based Education (OBE).

K. Program Matrix B. Pharmacy (B. Pharm.)

S. No.	Course Code	Course Name	Category	Numbers of Hours/Week			C
			Core / Elective / Others	L	T	P	
SEMESTER I							
1	BP101T	Human Anatomy and Physiology I	Major Core Course	3	1	-	4
2	BP102T	Pharmaceutical Analysis I – Theory	Major Core Course	3	1	-	4
3	BP103T	Pharmaceutics I – Theory	Major Core Course	3	1	-	4
4	BP104T	Pharmaceutical Inorganic Chemistry – Theory	Major Core Course	3	1	-	4
5	BP105T	Communication skills – Theory *	Major Core Course	2	-	-	2
6	BP106RBT	Remedial Biology/ Remedial	Major Core Course	2	-	-	2
	BP106RMT	Mathematics – Theory*					
7	BP107P	Human Anatomy and Physiology – Practical	Major Core Course	-	-	4	2
8	BP108P	Pharmaceutical Analysis I – Practical	Major Core Course	-	-	4	2
9	BP109P	Pharmaceutics I – Practical	Major Core Course	-	-	4	2
10	BP110P	Pharmaceutical Inorganic Chemistry – Practical	Major Core Course	-	-	4	2
11	BP111P	Communication skills – Practical*	Major Core Course	-	-	2	1
12	BP112P	Remedial Biology – Practical*	Major Core Course	-	-	2	1
13	SSE 001	Soft Skill Enhancement – I	SEC			NC	
Total				16	4	2 0	27/29 ^b /3 0
<p>Note: #Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.</p> <p>\$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.</p> <p>* Non University Examination (NUE), NC-Non Credit</p>							
SEMESTER II							
1	BP201T	Human Anatomy and Physiology II – Theory	Major Core Course	3	1	0	4
2	BP202T	Pharmaceutical Organic Chemistry I – Theory	Major Core Course	3	1	0	4
3	BP203T	Biochemistry – Theory	Major Core Course	3	1	0	4
4	BP204T	Pathophysiology – Theory	Major Core Course	3	1	0	4
5	BP205T	Computer Applications in Pharmacy – Theory *	Major Core Course	3	-	0	3
6	BP206T	Environmental sciences – Theory *	Major Core Course	3	-	0	3
7	BP207P	Human Anatomy and Physiology II – Practical	Major Core Course	-	-	4	2
8	BP208P	Pharmaceutical Organic Chemistry	Major Core Course	-	-	4	2

		I- Practical					
9	BP209P	Biochemistry – Practical	Major Core Course	-	-	4	2
10	BP210P	Computer Applications in Pharmacy – Practical*	Major Core Course	-	-	2	1
Total				18	4	14	29
Cumulative Total				34	8	34	56/58/59
SEMESTER III							
1	BP301T	Pharmaceutical Organic Chemistry II – Theory	Major Core Course	3	1	-	4
2	BP302T	Physical Pharmaceutics I – Theory	Major Core Course	3	1	-	4
3	BP303T	Pharmaceutical Microbiology – Theory	Major Core Course	3	1	-	4
4	BP304T	Pharmaceutical Engineering – Theory	Major Core Course	3	1	-	4
5	BP305P	Pharmaceutical Organic Chemistry II – Practical	Major Core Course	-	-	4	2
6	BP306P	Physical Pharmaceutics I – Practical	Major Core Course	-	-	4	2
7	BP307P	Pharmaceutical Microbiology – Practical	Major Core Course	-	-	4	2
8	BP 308P	Pharmaceutical Engineering – Practical	Major Core Course	-	-	4	2
	SE 001	Social Engineering/Yoga/Sports/Extra Curricular activity -I	AEC				NC
	MO 001	MOOCs/Foreign Language-I	AEC				NC
Total				12	4	16	24
Cumulative Total				46	12	50	80/82/83
SEMESTER IV							
1	BP401T	Pharmaceutical Organic Chemistry III– Theory	Major Core Course	3	1	-	4
2	BP402T	Medicinal Chemistry I – Theory	Major Core Course	3	1	-	4
3	BP403T	Physical Pharmaceutics II – Theory	Major Core Course	3	1	-	4
4	BP404T	Pharmacology I – Theory	Major Core Course	3	1	-	4
5	BP405T	Pharmacognosy and Phytochemistry I– Theory	Major Core Course	3	1	-	4
6	BP406P	Medicinal Chemistry I – Practical	Major Core Course	-	-	4	2
7	BP407P	Physical Pharmaceutics II – Practical	Major Core Course	-	-	4	2
8	BP408P	Pharmacology I – Practical	Major Core Course	-	-	4	2
9	BP409P	Pharmacognosy and Phytochemistry I – Practical	Major Core Course	-	-	4	2
	SSE 002	Soft Skill Enhancement – II	SEC				NC
	SE 002	Social Engineering/Yoga/Sports/Extra Curricular activity -II	AEC				NC
Total				15	5	16	28
Cumulative Total				61	17	66	108/110/111
SEMESTER V							
1	BP501T	Medicinal Chemistry II – Theory	Major Core Course	3	1	-	4
2	BP502T	Industrial PharmacyI– Theory	Major Core Course	3	1	-	4
3	BP503T	Pharmacology II – Theory	Major Core Course	3	1	-	4
4	BP504T	Pharmacognosy and Phytochemistry	Major Core Course	3	1	-	4

		II– Theory					
5	BP505T	Pharmaceutical Jurisprudence – Theory	Major Core Course	3	1	-	4
6	BP506P	Industrial PharmacyI – Practical	Major Core Course	-	-	4	2
7	BP507P	Pharmacology II – Practical	Major Core Course	-	-	4	2
8	BP508P	Pharmacognosy and Phytochemistry II – Practical	Major Core Course	-	-	4	2
	SSE 003	Soft Skill Enhancement – III	SEC				NC
	MO 002	MOOCs/Foreign Language-II	AEC				NC
	SE 003	Social Engineering/Yoga/Sports/Extra Curricular activity -III	AEC				NC
			Total	15	5	12	26
			Cumulative Total	76	22	78	134,136/137
Semester VI							
1	BP601T	Medicinal Chemistry III – Theory	Major Core Course	3	1	-	4
2	BP602T	Pharmacology III – Theory	Major Core Course	3	1	-	4
3	BP603T	Herbal Drug Technology – Theory	Major Core Course	3	1	-	4
4	BP604T	Biopharmaceutics and Pharmacokinetics – Theory	Major Core Course	3	1	-	4
5	BP605T	Pharmaceutical Biotechnology – Theory	Major Core Course	3	1	-	4
6	BP606T	Quality Assurance –Theory	Major Core Course	3	1	-	4
7	BP607P	Medicinal chemistry III – Practical	Major Core Course	-	-	4	2
8	BP608P	Pharmacology III – Practical	Major Core Course	-	-	4	2
9	BP609P	Herbal Drug Technology – Practical	Major Core Course	-	-	4	2
	SSE 004	Soft Skill Enhancement – IV	SEC				NC
	MO 003	MOOCs/Foreign Language-III	AEC				NC
	SE 004	Social Engineering/Yoga/Sports/Extra Curricular activity -IV	AEC				NC
			Total	18	6	12	30
			Cumulative Total	94	28	90	164/166/167
Semester VII							
1	BP701T	Instrumental Methods of Analysis – Theory	Major Core Course	3	1	-	4
2	BP702T	Industrial PharmacyII – Theory	Major Core Course	3	1	-	4
3	BP703T	Pharmacy Practice – Theory	Major Core Course	3	1	-	4
4	BP704T	Novel Drug Delivery System – Theory	Major Core Course	3	1	-	4
5	BP705P	Instrumental Methods of Analysis – Practical	Major Core Course	-	-	4	2
6	BP706PS	Practice School*	Major Core Course	-	-	12	6
	SSE 005	Soft Skill Enhancement – V	SEC				NC
	MO 004	MOOCs/Foreign Language-IV	AEC				NC
	SE 005	Social Engineering/Yoga/Sports/Extra Curricular activity -V	AEC				NC
			Total	12	4	16	24
			Cumulative Total	106	32	106	188/190/191
Semester VIII							

1	BP801T	Biostatistics and Research Methodology	Major Core Course	3	1	-	4
2	BP802T	Social and Preventive Pharmacy	Major Core Course	3	1	-	4
3	BP803ET	Pharma Marketing Management	DSE	3 + 3 = 6	1 + 1 = 2	-	4 + 4 = 8
4	BP804ET	Pharmaceutical Regulatory Science					
5	BP805ET	Pharmacovigilance					
6	BP806ET	Quality Control and Standardization of Herbals					
7	BP807ET	Computer Aided Drug Design					
8	BP808ET	Cell and Molecular Biology					
9	BP809ET	Cosmetic Science					
10	BP810ET	Experimental Pharmacology					
11	BP811ET	Advanced Instrumentation Techniques					
12	BP812ET	Dietary Supplements and Nutraceuticals					
13	BP813PW	Project Work	CAP	-	-	12	6
	SSE 006	Soft Skill Enhancement – VI	SEC				NC
	MO 005	MOOCs/Foreign Language-V	AEC				NC
			Total	12	4	12	22
			Cumulative Total	118	36	118	210/212/213
L – Lecture		T- Tutorial	P- Practical	C-Credits			
1L = 1Hr		1T= 1 Hr	1P=1 Hr	1C = 1 Hr of Theory Paper per week = 2 Hrs of Practical/Tutorial per week			

NC-Non Credit

Elective Courses (ELE)

Specialization Electives

BP 803ETPharma Marketing Management
 BP 804ETPharmaceutical Regulatory Science
 BP 805ETPharmacovigilance
 BP 806ETQuality Control and Standardization of Herbals
 BP 807ETComputer Aided Drug Design
 BP 808ETCell and Molecular Biology
 BP 809ETCosmetic Science
 BP 810ETExperimental Pharmacology
 BP 811ETAdvanced Instrumentation Techniques
 BP 812ETDietary Supplements and Nutraceuticals
 BP 813 ET Pharmaceutical Product Development

Major Core Course (MCC)				
S.No.	Course Name	Category	Code	Semester
1.	Human Anatomy and Physiology I	MCC	BP101T	I
2.	Pharmaceutical Analysis I – Theory	MCC	BP102T	I
3.	Pharmaceutics I – Theory	MCC	BP103T	I
4.	Pharmaceutical Inorganic Chemistry –Theory	MCC	BP104T	I
5.	Human Anatomy and Physiology –Practical	MCC	BP107P	I
6.	Pharmaceutical Analysis I – Practical	MCC	BP108P	I
7.	Pharmaceutics I – Practical	MCC	BP109P	I
8.	Human Anatomy and Physiology II – Theory	MCC	BP201T	II
9.	Pharmaceutical Organic Chemistry I – Theory	MCC	BP202T	II
10.	Biochemistry – Theory	MCC	BP203T	II
11.	Pathophysiology – Theory	MCC	BP204T	II
12.	Computer Applications in Pharmacy – Theory	MCC	BP205T	II
13.	Environmental sciences – Theory	MCC	BP206T	II
14.	Human Anatomy and Physiology II –Practical	MCC	BP207P	II
15.	Pharmaceutical Organic Chemistry I– Practical	MCC	BP208P	II
16.	Biochemistry – Practical	MCC	BP209P	II
17.	Computer Applications in Pharmacy – Practical*	MCC	BP210P	II
18.	Pharmaceutical Organic Chemistry II – Theory	MCC	BP301T	III
19.	Physical Pharmaceutics I – Theory	MCC	BP302T	III
20.	Pharmaceutical Microbiology – Theory	MCC	BP303T	III
21.	Pharmaceutical Engineering – Theory	MCC	BP304T	III
22.	Pharmaceutical Organic Chemistry II – Practical	MCC	BP305P	III
23.	Physical Pharmaceutics I – Practical	MCC	BP306P	III
24.	Pharmaceutical Microbiology – Practical	MCC	BP307P	III
25.	Pharmaceutical Engineering –Practical	MCC	BP 308P	III
26.	Pharmaceutical Organic Chemistry III– Theory	MCC	BP401T	IV
27.	Medicinal Chemistry I – Theory	MCC	BP402T	IV
28.	Physical Pharmaceutics II – Theory	MCC	BP403T	IV
29.	Pharmacology I – Theory	MCC	BP404T	IV
30.	Pharmacognosy and Phytochemistry I– Theory	MCC	BP405T	IV

31.	Medicinal Chemistry I – Practical	MCC	BP406P	IV
32.	Physical Pharmaceutics II – Practical	MCC	BP407P	IV
33.	Pharmacology I – Practical	MCC	BP408P	IV
34.	Pharmacognosy and Phytochemistry I – Practical	MCC	BP409P	IV
35.	Medicinal Chemistry II – Theory	MCC	BP501T	V
36.	Industrial PharmacyI– Theory	MCC	BP502T	V
37.	Pharmacology II – Theory	MCC	BP503T	V
38.	Pharmacognosy and Phytochemistry II– Theory	MCC	BP504T	V
39.	Pharmaceutical Jurisprudence – Theory	MCC	BP505T	V
40.	Industrial PharmacyI – Practical	MCC	BP506P	V
41.	Pharmacology II – Practical	MCC	BP507P	V
42.	Pharmacognosy and Phytochemistry II – Practical	MCC	BP508P	V
43.	Medicinal Chemistry III – Theory	MCC	BP601T	VI
44.	Pharmacology III – Theory	MCC	BP602T	VI
45.	Herbal Drug Technology – Theory	MCC	BP603T	VI
46.	Biopharmaceutics and Pharmacokinetics – Theory	MCC	BP604T	VI
47.	Pharmaceutical Biotechnology – Theory	MCC	BP605T	VI
48.	Quality Assurance –Theory	MCC	BP606T	VI
49.	Medicinal chemistry III – Practical	MCC	BP607P	VI
50.	Pharmacology III – Practical	MCC	BP608P	VI
51.	Herbal Drug Technology – Practical	MCC	BP609P	VI
52.	Instrumental Methods of Analysis – Theory	MCC	BP701T	VII
53.	Industrial Pharmacy II – Theory	MCC	BP702T	VII
54.	Pharmacy Practice – Theory	MCC	BP703T	VII
55.	Novel Drug Delivery System – Theory	MCC	BP704T	VII
56.	Instrumental Methods of Analysis – Practical	MCC	BP705P	VII
57.	Biostatistics and Research Methodology	MCC	BP801T	VIII
58.	Social and Preventive Pharmacy	MCC	BP802T	VIII
Ability Enhancement Course (AEC)				
S.NO.	Course Name	Category	Code	Semester
1	Social Engineering/Yoga/Sports/Extra Curricular activity -I	AEC	SE 001	III
2	MOOCs/Foreign Language-I	AEC	MO 001	III
3	Social Engineering/Yoga/Sports/Extra Curricular activity -II	AEC	SE 002	IV
4	MOOCs/Foreign Language-II	AEC	MO 002	V

5	Social Engineering/Yoga/Sports/Extra Curricular activity -III	AEC	SE 003	V
6	MOOCs/Foreign Language-III	AEC	MO 003	VI
7	Social Engineering/Yoga/Sports/Extra Curricular activity -IV	AEC	SE 004	VI
8	MOOCs/Foreign Language-IV	AEC	MO 004	VII
9	Social Engineering/Yoga/Sports/Extra Curricular activity -V	AEC	SE 005	VII
10	MOOCs/Foreign Language-V	AEC	MO 005	VIII
Skill Enhancement Courses (SEC)				
S.NO.	Course Name	Category	Code	Semester
1	Soft Skill Enhancement – I	SEC	SSE 001	I
2	Soft Skill Enhancement – II	SEC	SSE 002	IV
3	Soft Skill Enhancement – III	SEC	SSE 003	V
4	Soft Skill Enhancement – IV	SEC	SSE 004	VI
5	Soft Skill Enhancement – V	SEC	SSE 005	VII
6	Soft Skill Enhancement – VI	SEC	SSE 004	VIII
S.NO.	Course Name	Category	Code	Semester
1	Pharma Marketing Management	DSE	BP802T	VIII
2	Pharmaceutical Regulatory Science	DSE	BP803ET	VIII
3	Pharmacovigilance	DSE	BP804ET	VIII
4	Quality Control and Standardization of Herbals	DSE	BP805ET	VIII
5	Computer Aided Drug Design	DSE	BP806ET	VIII
6	Cell and Molecular Biology	DSE	BP807ET	VIII
7	Cosmetic Science	DSE	BP808ET	VIII
8	Experimental Pharmacology	DSE	BP809ET	VIII
9	Advanced Instrumentation Techniques	DSE	BP810ET	VIII
10	Dietary Supplements and Nutraceuticals	DSE	BP811ET	VIII
Value Added Course (VAC)				
S.NO.	Course Name	Category	Code	Semester
1	Biomedical Waste Management	VAC		I
2	Pharmaceutical Excipients	VAC		I
3	Human values and Ethics	VAC		I
4	Application of AI in the Healthcare Industry	VAC		II
5	Research Startup and Innovation	VAC		II
6	Pharmaceutical Quality Assurance	VAC		III
7	Plant Tissue Culture Techniques	VAC		III
8	Drug Store Management	VAC		IV
9	Process Validation	VAC		IV
10	Food Products and Nutraceuticals	VAC		IV
11	Application of Big Data in Pharmaceutical Industry	VAC		V
12	Industrial Cosmetic Science and Technology	VAC		V
13	Quality Control Techniques of Pharmaceuticals	VAC		V
14	ADR Monitoring & Pharmacovigilance	VAC		VI
15	Medical Devices	VAC		VI
16	Gene and Radio Therapy	VAC		VI
17	Medical and Scientific Writing	VAC		VII
18	Pharmaceutical Packaging	VAC		VII
19	Computational Drug Designing	VAC		VII
20	Scaling-up Techniques for Pharmaceuticals	VAC		VIII
21	Herbal Products and their Standardisation	VAC		VIII

22	Pre-Clinical Studies and Animal Modeling	VAC		VIII
Capstone Project (CAP)				
S.NO.	Course Name	Category	Code	Semester
1	Project Work	CAP	BP813PW	VIII

Semester – I

Program	Bachelor of Pharmacy	Semester I			
Course Name	Human Anatomy and Physiology-I	L	T	P	C
Course Code	BP101T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Impart fundamental knowledge of the structure and functions of the various systems of the human body.
2	Understand the various homeostatic mechanism of the human body.
3	Understand the coordinated working pattern of different organs of systems viz., Cardio-vascular system, nervous system and skeletal system.
4	Would be able to perform the hematological tests like blood cell counts, hemoglobin estimation, bleeding/clotting time etc., and also
5	Record blood pressure, heart rate, pulse and respiratory volume

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and explain the scope of anatomy and physiology, apply anatomical terminology, and interpret anatomical diagrams and charts.	L2 & L3
CO2	Describe the structure and functions of cells, tissues, skeletal system, joints, body fluids, blood, and lymphatic system.	L2
CO3	Explain the organization and functions of the peripheral nervous system, spinal and cranial nerves, and special sensory organs with related disorders.	L2
CO4	Describe the structure and functions of the heart and blood vessels, blood circulation, cardiac cycle, and autonomic regulation.	L2
CO5	Analyze and synthesize anatomical and physiological knowledge from multiple sources to evaluate recent advancements in the field.	L3 & L6

Syllabus:

Unit-1	Introduction to human body, Cellular level of organization, Tissue level of organization	Contact Hours: 10
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<p>Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.</p> <p>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.</p> <p>Classification of tissues, structure, location and functions of epithelial, muscular and nervous and</p>		
Unit-2	Integumentary system, Skeletal system, Joints	Contact Hours: 10
<p>Structure and functions of skin</p> <p>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.</p> <p>Structural and functional classification, types of joints movements and its articulation.</p>		
Unit-3	Body fluids and blood, Lymphatic system	Contact Hours: 10
<p>Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.</p> <p>Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system</p>		
Unit-4	Peripheral nervous system, Special senses	Contact Hours: 8
<p>Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves</p> <p>Structure and functions of eye, ear, nose and tongue and their disorders.</p>		
Unit-5	Cardiovascular system	Contact Hours: 7
<p>Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.</p>		

Suggestive Readings:

Text Books:

1. Anatomy and physiology by Agarwal.
2. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
3. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.

4. Physiological basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI USA
5. Text book of Medical Physiology- Arthur C, Guyton and John.E. Hall. Miamisburg, OH, U.S.A.
6. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
7. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
8. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
9. Practical workbook of Human Physiology by K. Sri Nageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

1. Physiological basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI USA.
2. Text book 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. Chatterjee, Academic Publishers Kolkata

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2		1							
CO2	3	1	2									
CO3	3	2			1	1						
CO4	3	2				2				1		
CO5	2	2	1	3	2			3	2	1	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Human Anatomy and Physiology I (Practical)	L	T	P	C
Course Code	BP107P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To identify and study different tissues and organs using charts and models.
2	To perform basic hematological experiments and physiological measurements.
3	To understand the principles of microscopy and staining techniques.
4	To develop skills in recording and interpreting experimental observations.
5	To build laboratory discipline, safety awareness, and documentation practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Identify different types of tissues using permanent slides.	L3
CO2	Perform basic hematological experiments such as Hb estimation and blood grouping.	L3
CO3	Record and interpret physiological parameters like pulse rate and blood pressure.	L3 & L2
CO4	Identify bones and organs using models and charts.	L4
CO5	Demonstrate good laboratory practices and proper record maintenance.	L3

Syllabus

BP 107 P	Human Anatomy and Physiology I (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Study of compound microscope 2. Microscopic study of epithelial tissue 3. Microscopic study of connective tissue 4. Microscopic study of muscular tissue 5. Microscopic study of nervous tissue 6. Identification of bones of axial and appendicular skeleton 7. Study of joints (types) using models 8. Determination of bleeding time 9. Determination of clotting time 10. Estimation of hemoglobin content 11. Determination of blood group 12. Counting of RBC and WBC (demonstration) 13. <input type="checkbox"/> Recording of pulse rate 		

Books:

Text Books:

T1 Human Anatomy and Physiology by K.S. Tortora & G.J. Derrickson
T2 Textbook of Medical Physiology by Arthur C. Guyton & John E. Hall

Reference Books

R1 Essentials of Medical Physiology by K. Sembulingam & Prema Sembulingam
R2 Practical Human Anatomy and Physiology Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO ↓												

CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Pharmaceutical Analysis	L	T	P	C
Course Code	BP102T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the principles of volumetric and electrochemical analysis.
2	Carryout various volumetric and electrochemical titrations.
3	Gain skills in selecting analytical techniques for the estimation of drugs.
4	Understand the relevance and applications and analytical techniques in the pharmaceutical field.
5	Interpret choice of analytical technique to perform the estimation of different categories of drugs.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define pharmaceutical analysis, identify techniques of analysis, and explain types and sources of errors, accuracy, precision, and pharmacopoeial standards.	L1& L2
CO2	Classify titrations and explain the theory of acid-base indicators and titration curves; apply this to analyze sodium benzoate and Ephedrine HCl.	L2& L3
CO3	Demonstrate precipitation and complexometric titration methods; estimate analytes like NaCl, MgSO ₄ , Ca gluconate, and BaSO ₄ using gravimetric principles.	L3& L4

CO4	Analyze types of redox titrations and apply appropriate redox methods such as iodometry, bromatometry, and cerimetry in quantitative analysis.	L3& L4
CO5	Explain the principles and instrumentation of conductometry, potentiometry, and polarography; interpret titration results based on electrochemical methods.	L2& L4

Syllabus:

Unit-1	Pharmaceutical analysis, Errors	Contact Hours: 10
<p>Pharmaceutical analysis- Definition and scope</p> <p>i) Different techniques of analysis</p> <p>ii) Methods of expressing concentration</p> <p>iii) Primary and secondary standards.</p> <p>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</p> <p>Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.</p>		
Unit-2	Acid base titration, Non aqueous titration	Contact Hours: 10
<p>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.</p> <p>Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl</p>		
Unit-3	Precipitation titrations, Complexometric titration & Gravimetry	Contact Hours: 10
<p>Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.</p> <p>Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.</p> <p>Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.</p> <p>Basic Principles, methods and application of diazotization titration.</p>		
Unit-4	Redox titrations	Contact Hours: 8
<p>(a) Concepts of oxidation and reduction</p> <p>(b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate</p>		
Unit-5	Electrochemical methods of analysis	Contact Hours: 7
<p>Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications.</p> <p>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.</p>		

Suggestive Readings:**Text Books:**

1. PC Kamboj, Pharmaceutical Analysis, Volume -1 , Vallabh Publications, Edition 2, 2007
2. P.Parimoo, Pharmaceutical Analysis, CBS Publisher and Distribution Pvt. LTd, First Edition 2017.
3. G Vidya Sagar. Instrumental Methods of Analysis, PharmaMed Press, Hyderabad, 2009
4. A.I. Vogel, Text Book of Quantitative Inorganic analysis
5. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
6. Indian Pharmacopoeia.

Reference Books:

1. Bentley and Driver's Textbook of Pharmaceutical Chemistry
2. John H. Kennedy, Analytical chemistry principles
3. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1 hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1 hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3 hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2	2									
CO3	3	3		2	2							
CO4	3	3		2	2							
CO5	3	2		2	3							

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Pharmaceutical Analysis (Practical)	L	T	P	C
Course Code	BP108P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	Develop skills in preparation and standardization of volumetric solutions.
2	Train students in performing acid-base titrations.
3	Provide practical knowledge of redox titrations.
4	Enable estimation of pharmaceutical substances using titrimetric methods.
5	Develop accuracy, precision, and documentation skills in analytical experiments.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Prepare and standardize volumetric solutions.	L3
CO2	Perform acid-base titrations for estimation of pharmaceutical substances.	L3
CO3	Perform redox titrations using standard procedures.	L3 & L2
CO4	Calculate assay results and interpret analytical data.	L4
CO5	Maintain laboratory records and follow GLP practices.	L3

Syllabus

BP 107 P	Pharmaceutical Analysis (Practical)	Contact Hours: 4 Hours/week
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<p>1.Preparation and Standardization of Solutions Preparation and standardization of sodium hydroxide solution Preparation and standardization of hydrochloric acid solution Preparation and standardization of sulfuric acid solution</p> <p>2.Acid–Base Titrations Estimation of sodium carbonate Estimation of sodium bicarbonate Estimation of boric acid</p> <p>3.Redox Titrations Estimation of ferrous sulfate using potassium permanganate Estimation of oxalic acid using potassium permanganate Estimation of hydrogen peroxide</p> <p>4.Assay of Official Compounds (as per IP) Assay of aspirin Assay of ibuprofen</p>

Books:

Text Books: Pharmaceutical Analysis by Chatwal & Anand

Textbook of Pharmaceutical Analysis by K.A. Connors

Reference Books

Vogel’s Textbook of Quantitative Chemical Analysis by Jeffery et al.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			

CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Pharmaceutics-I	L	T	P	C
Course Code	BP103T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the historical background and development of the profession of pharmacy, especially in India, in relation to education, industry, and professional
2	Understand pharmaceutical calculations, including weights and measures in the Imperial and Metric systems.
3	Understand the concept of biphasic liquid dosage forms, especially suspensions and emulsions.
4	Know the professional way of handling the prescription
5	Perform preparation of various conventional dosage forms

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the historical evolution and development of pharmacy profession, various dosage forms, parts of prescription, and factors affecting posology.	L2
CO2	Perform pharmaceutical calculations including percentage solutions, allegation, proof spirit, and isotonic solutions, and classify powders and liquid dosage	L3
CO3	Distinguish between monophasic and biphasic liquids, and explain their preparation, classification, and stability issues.	L2
CO4	Explain the formulation of suppositories, calculate displacement values, and identify types of pharmaceutical incompatibilities with examples.	L3
CO5	Prepare and evaluate semisolid dosage forms, and describe mechanisms of drug penetration and functions of excipients.	L3

Syllabus:

Unit-1	Historical background and development of the profession of pharmacy, Dosage forms, Prescription & Posology	Contact Hours: 10
<p>Historical background and development of the profession of pharmacy: History of the profession of Pharmacy in India in relation to pharmacy education, industry, and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP, and Extra Pharmacopoeia.</p> <p>Dosage forms: Introduction to dosage forms, classification, and definitions.</p> <p>Prescription: Definition, Parts of prescription, handling of Prescription, and Errors in prescription.</p> <p>Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight, and body surface area.</p>		
Unit-2	Pharmaceutical calculations, Powders & Liquid dosage forms	Contact Hours: 10
<p>Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight.</p> <p>Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent, and hygroscopic powders, eutectic mixtures. Geometric dilutions.</p> <p>Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.</p>		
Unit-3	Monophasic liquids & Biphasic liquids	Contact Hours: 8
<p>Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.</p> <p>Biphasic liquids:</p> <p>Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.</p> <p>Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.</p>		
Unit-4	Suppositories & Pharmaceutical incompatibilities	Contact Hours: 8
<p>Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.</p> <p>Pharmaceutical incompatibilities: Definition, classification, physical, chemical, and therapeutic incompatibilities with examples.</p>		
Unit-5	Semisolid dosage forms	Contact Hours: 7
<p>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.</p>		

Suggestive Readings:

Text Books:

1. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
2. Pharmaceutics I by gupta A.K , CBS

References:

1. Dosages from deginge by Kokate and others, Nirali
2. Pharmaceutics basic principles and formulation by Tripathi D.K , BSP

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Mapping of Course Outcomes with Program Outcomes:

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1						1	2		2
CO2	3	3	2		2				1	2		2
CO3	3	2	2		2				1	2		2
CO4	3	2	2	1	1	1		1	1	2		2
CO5	3	2	3	1	2		1	1	1	2	1	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Pharmaceutics(Practical)	L	T	P	C
Course Code	BP109P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	Recall pharmaceutical calculations, compounding principles, and labeling requirements.
2	Develop skills in preparation of monophasic and biphasic liquid dosage forms.
3	Prepare monophasic and biphasic dosage forms as per official procedures.
4	Differentiate between various pharmaceutical preparations based on formulation principles.
5	Assess the quality and stability of prepared dosage forms..

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the principles of compounding and dispensing.	L3
CO2	Prepare monophasic liquid dosage forms (syrups, elixirs, linctus).	L3
CO3	Prepare biphasic systems (suspensions, emulsions) and evaluate them.	L3 & L2
CO4	Prepare solid and semisolid dosage forms (powders, ointments, creams, gels).	L4
CO5	Analyze prescriptions and dispense with accurate labeling.	L3

Syllabus

BP 109 P	Pharmaceutics (Practical)	Contact Hours: 4 Hours/week
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1. Preparation of Syrup
2. Preparation of Elixir
3. Preparation of Linctus
4. Preparation of Suspension
5. Preparation of Emulsion
6. Preparation of Powders (Simple and Compound)
7. Preparation of Ointment
8. Preparation of Cream
9. Preparation of Gel
10. Preparation of Suppository
11. Preparation of Gargle
12. Preparation of Mouthwash
13. Dispensing of Prescriptions (Minimum Two)
14. Labelling and Packaging of Dispensed Products

Books:

1. A Textbook of Pharmaceutics by C.V.S. Subrahmanyam
2. Dispensing Pharmacy by R.M. Mehta
3. Pharmaceutics – The Science of Dosage Form Design by Michael E. Aulton

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester-I			
Course Name	Pharmaceutical Inorganic Chemistry	L	T	P	C
Course Code	BP104T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To learn and understand them on a graph so find organic drugs and pharmaceuticals.
2	To know the sources of impurities.
3	Understand the methods to determine the impurities in inorganic drugs and
4	Understand the medicinal and pharmaceutical importance of inorganic compounds.
5	Know the different semi-quantitative test for Inorganic pharmaceuticals.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the history and evolution of pharmacopoeias, sources and types of impurities, and explain the principles involved in limit tests for inorganic pharmaceutical substances .	L1 & L2
CO2	Explain the concepts of acids, bases, buffers, isotonicity, and physiological ions, and apply buffer systems and electrolyte knowledge in pharmaceutical formulations and therapies.	L2 & L3
CO3	Summarize the uses, mechanisms, and classifications of gastrointestinal and antimicrobial agents and explain the properties of commonly used inorganic compounds.	L1 & L2
CO4	Discuss the uses and assays of miscellaneous inorganic compounds including expectorants, emetics, haematinics, antidotes, and astringents used in pharmaceutical practice.	L2 & L3

CO5	Describe the principles of radioactivity, its measurement, radiopharmaceutical applications, precautions, and storage conditions of radioactive substances.	L2 & L3
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Syllabus:

Unit-1	Impurities in pharmaceutical substances	Contact Hours: 10
<p>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.</p> <p>General methods of preparation, assay for the compounds superscripted with asterisk (*), properties and medicinal uses of inorganic compounds belonging to the following classes</p>		
Unit-2	Acids, Bases and Buffers, Major extra and intracellular electrolytes & Dental products	Contact Hours: 10
<p>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.</p> <p>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.</p> <p>Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.</p>		
Unit-3	Gastrointestinal agents	Contact Hours: 10
<p>Acidifiers: Ammonium chloride and Dil. HCl</p> <p>Antacid: Ideal properties of antacids, combinations of antacids, Sodium 40 Bicarbonate, Aluminum hydroxide gel, Magnesium hydroxide mixture</p> <p>Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite</p> <p>Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations</p>		
Unit-4	Miscellaneous compounds	Contact Hours: 8
<p>Expectorants: Potassium iodide, Ammonium chloride*.</p> <p>Emetics: Copper sulphate*, Sodium potassium tartarate</p> <p>Haematinics: Ferrous sulphate*, Ferrous gluconate</p> <p>Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite³³³</p> <p>Astringents: Zinc Sulphate, Potash Alum</p>		
Unit-5	Radiopharmaceuticals	Contact Hours: 7
<p>Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I 131 , Storage conditions, precautions & pharmaceutical application of radioactive substances.</p>		

Text Books:

T1-Dr.A.V. Kasture, Dr.S.G. Wadodkar, pharmaceutical inorganic chemistry

T2- Kar A, Advanced Inorganic Chemistry, CBS Publisher 2018 edition.

T3- Prakash S, Advanced Inorganic Chemistry, S. Chand.

T4- Pandeya, Elementary Inorganic Chemistry

T5- RD Madan Pharmaceutical Inorganic Chemistry, S. Chand Publisher

References:

R1-Gupta and Grover, A Practical Book of Pharmaceutical Inorganic Chemistry.

R2- Kasture and Wadokar, Pharmaceutical Inorganic Chemistry.

R3- Indian Pharmacopoeia

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								1		
CO2	3	2	2		1					1		1
CO3	3	2				1				1		
CO4	3	2				1				1		
CO5	2	2		2	2	2		1				2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Pharmaceutical Inorganic Chemistry(Practical)	L	T	P	C
Course Code	BP110P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform limit tests as per pharmacopoeial standards.
2	To estimate inorganic pharmaceutical substances by titrimetric methods.
3	To identify inorganic compounds using qualitative analysis.
4	To prepare and standardize solutions used in pharmaceutical analysis.
5	To develop laboratory skills and proper documentation practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform Limit Tests As Per Pharmacopoeial Standards.	L3
CO2	Estimate Inorganic Pharmaceutical Substances By Titrimetric Methods.	L3
CO3	Identify Inorganic Compounds Using Qualitative Analysis.	L3
CO4	Prepare And Standardize Solutions Used In Pharmaceutical Analysis.	L4
CO5	Develop Laboratory Skills And Proper Documentation Practices.	L3

BP 110P	Pharmaceutical Chemistry(Practical)	Inorganic	Contact Hours: 4 Hours/week
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I. Limit Tests (As per IP)

1. Limit test for chloride
2. Limit test for sulphate
3. Limit test for iron
4. Limit test for heavy metals

II. Volumetric Analysis

5. Estimation of sodium chloride
6. Estimation of sodium bicarbonate
7. Estimation of boric acid
8. Estimation of magnesium sulphate
9. Estimation of calcium gluconate

III. Identification Tests

10. Identification tests for inorganic pharmaceutical compounds
11. Test for purity as per pharmacopoeial standards

Books:**Text Books**

T1 Pharmaceutical Inorganic Chemistry by A.H. Beckett & J.B. Stenlake

T2 Pharmaceutical Inorganic Chemistry by Anand & Chatwal

Reference Books

R1 Indian Pharmacopoeia

R2 Vogel's Textbook of Quantitative Chemical Analysis

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	COMMUNICATION SKILLS (Theory)	L	T	P	C
Course Code	BP105T	2	0	0	2

Course Objectives:

This course ensures that the students understand how:

1	To understand the behavioral requirements for a pharmacist to function effectively in pharmaceutical operations and professional settings.
2	To communicate effectively using verbal and non-verbal communication skills.
3	To work efficiently in a team and demonstrate qualities of an effective team player.
4	To develop interview skills and professional presentation abilities.
5	To develop leadership qualities and essential managerial skills required in pharmacy practice.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand The Behavioral Requirements For A Pharmacist To Function Effectively In Pharmaceutical Operations And Professional Settings.	L3
CO 2	Communicate Effectively Using Verbal And Non-Verbal Communication Skills.	L3
CO 3	Work Efficiently In A Team And Demonstrate Qualities Of An	L3

	Effective Team Player.	
CO 4	Develop Interview Skills And Professional Presentation Abilities.	L4
CO 5	Develop Leadership Qualities And Essential Managerial Skills Required In Pharmacy Practice.	L3

BP 105T	COMMUNICATION SKILLS (Theory)	Contact Hours
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<p>UNIT – I 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</p>	<p>07 Hours</p>
<p>UNIT – II 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</p>	<p>07 Hours</p>
<p>UNIT – III Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, 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</p>	<p>07 Hours</p>
<p>UNIT – IV 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</p>	<p>05 Hours</p>
<p>UNIT – V Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion</p>	<p>04 Hours</p>

Books:**Text Books**

T1 Communication Skills for Professionals by Sanjay Kumar & Pushp Lata
 T2 Organizational Behaviour by Stephen P. Robbins

Reference Books

R1 Business Communication by K.K. Sinha
 R2 Soft Skills by Alex K.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	2hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1				1			
CO2	2			1	1				2			
CO3	2	2	2		1				1			
CO4	1	2	2	2	1			1				
CO5	2	2	1			1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	COMMUNICATION SKILLS (Practical)	L	T	P	C
Course Code	BP111P	0	0	2	1

Course Objectives:

This course ensures that the students understand how:

1	To understand the behavioral requirements for a pharmacist to function effectively in pharmaceutical operations and professional settings.
2	To communicate effectively using verbal and non-verbal communication skills.
3	To work efficiently in a team and demonstrate qualities of an effective team player.
4	To develop interview skills and professional presentation abilities.
5	To develop leadership qualities and essential managerial skills required in pharmacy practice.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO 1	Understand The Behavioral Requirements For A Pharmacist To Function Effectively In Pharmaceutical Operations And Professional Settings.	L3
CO 2	Communicate Effectively Using Verbal And Non-Verbal Communication Skills.	L3
CO 3	Work Efficiently In A Team And Demonstrate Qualities Of An Effective Team Player.	L3
CO 4	Develop Interview Skills And Professional Presentation Abilities.	L4
CO 5	Develop Leadership Qualities And Essential Managerial Skills Required In Pharmacy Practice.	L3

BP 111P	COMMUNICATION (Practical)	SKILLS	Contact Hours: / 2 hr week
<p>Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do? Do's and Dont's</p> <p>Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)</p> <p>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</p>			

Books:

Text Books

T1 Communication Skills for Professionals by Sanjay Kumar & Pushp Lata
T2 Organizational Behaviour by Stephen P. Robbins

Reference Books

R1 Business Communication by K.K. Sinha
R2 Soft Skills by Alex K.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	2hr	2.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	2hr	2.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	2hr	15			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1				1			
CO2	2			1	1				2			
CO3	2	2	2		1				1			
CO4	1	2	2	2	1			1				
CO5	2	2	1			1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy				Semester I			
Course Name	Remedial Mathematics				L	T	P	C
Course Code	BP106 RMT				2	0	0	2

Course Objectives:

This course ensures that the students understand how:

1	Understand the basic concepts of algebra, functions, limits, and continuity used in pharmaceutical calculations.
2	Learn the principles of matrices and determinants and their use in solving system of equations.
3	Understand the fundamentals of differential and integral calculus and their applications.
4	Develop problem-solving skills in analytical geometry, differentiation, and integration.
5	Apply differential equations and Laplace transforms in chemical kinetics and pharmacokinetics problems.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the concepts of partial fractions, logarithms, functions, limits, and	L2

	continuity with suitable examples.	
CO2	Apply matrices and determinants to solve system of linear equations and pharmacokinetic problems.	L3
CO3	Use differentiation and integration techniques to solve standard mathematical and pharmaceutical problems.	L3
CO4	Analyze problems related to analytical geometry, maxima–minima, and calculus-based applications.	L4
CO5	Apply differential equations and Laplace transforms to solve problems in chemical kinetics and pharmacokinetics.	L3

Syllabus:

Unit-1	Partial fraction	Contact Hours: 6
<p>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</p> <ul style="list-style-type: none"> • 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 ($\epsilon - \delta$ definition), $\lim_{x \rightarrow a} x - a = n a_{n-1}$, $\lim_{\theta \rightarrow 0} \sin \theta = 1$, $\lim_{\theta \rightarrow 0} \frac{x - a}{\theta}$ 		
Unit-2	Matrices and Determinant	Contact Hours: 6

<p>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</p>		
Unit-3	Calculus Differentiation	Contact Hours: 6
<p>Calculus 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 $\log_e x$, Derivative of a^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</p>		
Unit-4	Analytical Geometry Introduction	Contact Hours: 6
<p>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</p>		
Unit-5	Differential Equations	Contact Hours: 6

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**

Books:

Text Books

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.

Reference Books

1. Integral Calculus by Shanthinarayan
2. Higher Engineering Mathematics by Dr.B.S.Grewal

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	2hr	35			Traditional	Levels 1 to 5

Course Outcomes and Program Outcomes (CO-PO) Articulation Matrix

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO ↓												
CO1	3	2	1	1	1							2
CO2	3	3	2	2	2				1		1	2
CO3	3	3	2	2	2				1		1	2
CO4	2	3	2	3	2				1		1	2
CO5	3	3	2	3	2	1			1		1	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	Remedial Biology (Theory)	L	T	P	C
Course Code	BP106 RBT	2	0	0	2

Course Objectives:

This course ensures that the students understand how:

1	Explain Cell biology(Basic Nature of Plant cell and Animal cell)
2	Discuss classification System of both Plants &Animals
3	Identify various tissue system and organ system in plant and animals
4	Discuss the theory of evolution
5	Discuss anatomy and Physiology of plants and animals

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and describe the characteristics of living organisms, classification systems, and morphology of flowering plants.	L1 & L2
CO2	Explain the structure and physiological processes related to human body systems – circulation, digestion, respiration, excretion, and reproduction.	L2
CO3	Illustrate neural and hormonal coordination in humans, highlighting structure and functions of related systems.	L2 & L3
CO4	Analyze plant physiological processes including mineral nutrition, nitrogen metabolism, and photosynthesis.	L3

CO5	Summarize plant respiration, growth regulators, cell structure, cell division, and types of tissues with their roles.	L2 & L3
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Syllabus:

Unit-1	Living world & Morphology of Flowering plants	Contact Hours: 7
<p>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, Protista, Fungi, Animalia and Plantae, Virus,</p> <p>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 & Dicotyledones</p>		
Unit-2	Body fluids and circulation, Digestion and Absorption & Breathing and respiration	Contact Hours: 7

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-3

Excretory products and their elimination, Neural control and coordination, Chemical coordination and regulation & Human reproduction

Contact Hours: 7**Excretory products and their elimination**

Modes of excretion
 Human excretory system- structure and function
 Urine formation
 Renin 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-4

Plants and mineral nutrition &

Contact Hours: 5

	Photosynthesis	
<p>Plants and mineral nutrition: Essential mineral, macro and micronutrients Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation</p> <p>Photosynthesis Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.</p>		
Unit-5	Plant respiration, Plant growth and development, Cell - The unit of life & Tissues	Contact Hours: 4
<p>Plant respiration: Respiration, glycolysis, fermentation (anaerobic).</p> <p>Plant growth and development Phases and rate of plant growth, Condition of growth, Introduction to plant growth Regulators.</p> <p>Cell - The unit of life Structure and functions of cell and cell organelles. Cell division</p> <p>Tissues Definition, types of tissues, location and functions.</p>		

Books:

Text Books

1. Text book of Biology by S. B. Gokhale
2. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram.

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C.Dutta.
4. Outlines of Zoology by M. Ekambaranathaayyer and T. N. Ananthkrishnan.
5. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Scheme of Evaluation:

Component	Adopted for this	Duration	Weightage	Date &	Venue	Remarks	Levels
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	Course			Time			
Test I	☑	1hr	5			Traditional	Levels 3 to 5
Test II	☑	1hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	2hr	35			Traditional	Levels 1 to 5

Course Outcomes and Program Outcomes (CO-PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								1		
CO2	3	2	2			1						1
CO3	2	3	2		1	2		1		1		2
CO4	2	3	2	2	2		1					1
CO5	2	2	2	2	2		2				1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester I			
Course Name	REMEDIAL BIOLOGY (Practical)	L	T	P	C
Course Code	BP112RBP	0	0	2	1

Course Objectives:

This course ensures that the students understand how:

1	Understand the classification and salient features of the five kingdoms of life.
2	Explain the structural organization of plant cells, tissues, and organs.
3	Describe the basic physiological processes occurring in plants.

4	Explain the structural organization of animal tissues and organ systems with special reference to humans.
5	Understand the basic physiological mechanisms of major human body systems.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO 1	Understand the classification and salient features of the five kingdoms of life.	L3
CO 2	Explain the structural organization of plant cells, tissues, and organs.	L3
CO 3	Describe the basic physiological processes occurring in plants.	L3
CO 4	Explain the structural organization of animal tissues and organ systems with special reference to humans.	L4
CO 5	Understand the basic physiological mechanisms of major human body systems.	L3

BP 112RBP	REMEDIAL BIOLOGY (Practical)	Contact Hours: / 02hr week
1. Introduction to experiments in biology a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation 2. Study of cell and its inclusions 3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications 4. Detailed study of frog by using computer models 5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower 6. Identification of bones 7. Determination of blood group 8. Determination of blood pressure 9. Determination of tidal volume		

Books:

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

.Reference Books

- a. A Text book of Biology by B.V. Sreenivasa Naidu
- b. A Text book of Biology by Naidu and Murthy

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	2hr	2.5			Traditional	Levels 3 to 5
Test II	☑	2hr	2.5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	2hr	15			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1				1			
CO2	2			1	1				2			
CO3	2	2	2		1				1			
CO4	1	2	2	2	1			1				
CO5	2	2	1			1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Human Anatomy and Physiology-I	L	T	P	C
Course Code	BP201T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Explain the gross morphology, structure and functions of various organs of the human body.
2	Describe the various homeostatic mechanisms and their imbalances corresponding to digestive system and Formation and role of ATP, Creatinine Phosphate and BMR.
3	Identify the various tissues and organs of different systems of human body like respiratory and urinary system.
4	Understand Hormonal Classification with Mechanisms and Comprehend Thyroid and Parathyroid Gland Functions.
5	Identify the basic principles of genetic inheritance patterns and their implications for traits and disorders.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and describe the organization and function of the nervous system, including neurons, synapses, neurotransmitters, and major structures of the brain and spinal cord.	L1 & L2
CO2	Explain the anatomy and physiology of the gastrointestinal tract, salivary glands, pancreas, liver, and the biochemical aspects of digestion and energetics.	L2 & L3
CO3	Describe the structure and function of the respiratory and urinary systems, including mechanisms of respiration, urine formation, and the role of kidneys in homeostasis.	L2 & L3
CO4	Discuss the classification, mechanism of action, and physiological functions of hormones secreted by various endocrine glands and relate them to associated disorders.	L2 & L4
CO5	Explain the structure and function of male and female reproductive systems, sex hormones, gametogenesis, and basic principles of genetics including inheritance patterns.	L2& L3

Syllabus:

Unit-1	Nervous system	Contact Hours: 10
<p>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)</p>		
Unit-2	Digestive system and Energetics	Contact Hours: 06
<p>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.</p>		
Unit-3	Respiratory system and Urinary system	Contact Hours: 10
<p>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.</p>		
Unit-4	Endocrine system	Contact Hours: 10
<p>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.</p>		
Unit-5	Reproductive system and Introduction to genetics	Contact Hours: 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**Books:****Text Books:**

1. Anatomy and physiology by Agarwal.
2. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
3. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
4. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
5. Text book of Medical Physiology- Arthur C, Guyton and John.E. Hall. Miamisburg, OH, U.S.A.
6. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
7. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
8. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
9. Practical workbook of Human Physiology by K. Sri Nageswari and Rajeev Sharma, 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. Text book 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. Chatterjee, Academic Publishers Kolkata

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1								
CO2	3	2	2	1								2
CO3	3	2	2	2	2	2	2					2
CO4	3	3	2	3	2	2	2	2				2
CO5	3	2	2	2	2	2		2	2	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Human Anatomy and Physiology II (Practical)	L	T	P	C
Course Code	BP207P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To study the anatomy and physiology of cardiovascular and respiratory systems using models and charts.
2	To perform basic experiments related to digestive and endocrine systems.
3	To record physiological parameters related to heart and lung function.
4	To understand the structure of urinary and reproductive systems.
5	To develop laboratory skills, interpretation ability, and proper documentation practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Identify parts of heart, respiratory, digestive, urinary and reproductive systems using models.	L3
CO2	Perform experiments related to cardiovascular and respiratory physiology.	L3

CO3	Record and interpret physiological parameters.	L3 & L2
CO4	Explain the functions of endocrine glands using charts and models.	L4
CO5	Maintain laboratory records and follow GLP practices.	L3

Syllabus

BP 207 P	Human Anatomy and Physiology II (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Study of different systems with the help of models: <ul style="list-style-type: none"> • Cardiovascular system • Respiratory system • Digestive system • Urinary system • Reproductive system 2. Study of human heart using specimen/model 3. Study of electrocardiogram (ECG) (Demonstration) 4. Measurement of blood pressure 5. Determination of respiratory rate 6. Spirometry (Demonstration) 7. Study of endocrine glands using charts and models 8. Identification of histological slides related to heart, lung, kidney, and intestine 		

Books:

Text Books:

T1 Human Anatomy and Physiology by K.S. Tortora & G.J. Derrickson
T2 Textbook of Medical Physiology by Arthur C. Guyton & John E. Hall

Reference Books:

R1 Essentials of Medical Physiology by K. Sembulingam & Prema Sembulingam
R2 Ross and Wilson Anatomy and Physiology in Health and Illness

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1

Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5
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Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Pharmaceutical Organic Chemistry	L	T	P	C
Course Code	BP202T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To provide foundational knowledge of the structure, bonding, and classification of organic compounds, including concepts like hybridization, resonance, and electronic effects.
2	To develop understanding of IUPAC nomenclature and stereochemistry, including isomerism, chirality, and optical activity of organic molecules.
3	To explain reaction mechanisms of key organic transformations such as substitution, addition, and elimination, along with the study of reactive intermediates.
4	To introduce aromaticity and electrophilic aromatic substitution , enabling students to predict the behavior of aromatic compounds under various conditions.
5	To impart practical skills in synthesizing, purifying, and characterizing organic compounds, with an emphasis on reactions relevant to pharmaceutical applications.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand the fundamental concepts of organic chemistry including hybridization, resonance, inductive and mesomeric effects, IUPAC nomenclature, and classification of organic compounds.	L2
CO2	Apply knowledge of reaction mechanisms (nucleophilic substitution, electrophilic addition, elimination, free radical reactions) and reaction intermediates (carbocations, carbanions, free radicals) to predict chemical behavior.	L3
CO3	Analyze stereochemistry concepts such as optical activity, geometrical isomerism, chirality, enantiomers, diastereomers, and interpret conformational analysis using Newman and Fischer projections.	L4
CO4	Evaluate aromaticity using Huckel's rule and predict the outcomes of electrophilic aromatic substitution reactions.	L4
CO5	Demonstrate practical skills in the synthesis, characterization, and application of organic compounds relevant to pharmaceutical and medicinal chemistry.	L3

Syllabus:

Unit-1	Classification, nomenclature and isomerism	Contact Hours: 07
Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds		
Unit-2	Alkanes*, Alkenes* and Conjugated dienes	Contact Hours: 10
SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions– kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 versus E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition 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-3	Alkylhalides & Alcohols	Contact 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 ethylchloride, 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-4	Carbonyl compounds* (Aldehydes and ketones)	Contact 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-5	Carboxylic acids & Aliphatic amines	Contact Hours: 7
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		

Books:**Text Books:**

T1. S.K. Bhasin, Reena Gupta, "Pharmaceutical Organic Chemistry", Elsevier, First Edition 2012

T2. Arun Bahl and B.S. Bahl, "A Text book of Advanced Organic Chemistry",

Reference Books:

R1. Dr. Sheshagiri Dixit, "Pharmaceutical Organic Chemistry I", Notion Press, First Edition 2022.

R2. Dr. Sandeep Kumar & Ashish Srivastava, "Pharmaceutical Organic Chemistry I", R. Narain Publishers & Distributors, Second Edition 2019.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		2							
CO2	3	3		3	2							
CO3	3	3		2	2			1				
CO4	3	2		2		1	2					1
CO5	3	3	2	3	3	2	1	2	1	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Pharmaceutical Organic Chemistry -I(Practical)	L	T	P	C
Course Code	BP208P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform systematic qualitative analysis of organic compounds.
2	To detect extra elements such as nitrogen, sulphur, and halogens.
3	To determine physical constants of organic compounds.
4	To prepare suitable derivatives for identification of compounds.
5	To purify organic compounds using standard laboratory techniques.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform detection of extra elements and preliminary tests for organic compounds.	L3
CO2	Identify functional groups present in unknown organic compounds.	L3
CO3	Determine melting point and boiling point of organic substances.	L3 & L2
CO4	Prepare suitable derivatives for confirmation of organic compounds.	L4
CO5	Purify organic compounds by recrystallization and distillation techniques.	L3

Syllabus

BP 208 P	Pharmaceutical Organic Chemistry-I(Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Detection of extra elements (Lassaigne's test) – Nitrogen, Sulphur, Halogens 2. Preliminary tests – Solubility, Litmus, Ignition test 3. Systematic qualitative analysis of organic compounds containing one functional group: <ul style="list-style-type: none"> • Phenols • Amides • Carbohydrates • Aldehydes • Ketones • Carboxylic acids 4. Aromatic primary amines 5. Nitro compounds 6. Determination of melting point of organic compounds 7. Determination of boiling point of liquid organic compounds 8. Preparation of suitable derivatives for identification 9. Recrystallization of organic compounds 10. Simple distillation 11. Fractional distillation 12. Steam distillation (Demonstration) 13. Thin Layer Chromatography (Demonstration) 14. Separation of binary mixtures (Demonstration) 		

Books:

T1 Organic Chemistry by Morrison & Boyd
T2 Practical Organic Chemistry by A.I. Vogel
T3 Organic Chemistry by I.L. Finar

Reference Books:

R1 Advanced Practical Organic Chemistry by J. Leonard
R2 Organic Chemistry by B.S. Bahl & Arun Bahl

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1

Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5
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Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester-II			
Course Name	Biochemistry	L	T	P	C
Course Code	BP 203T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand the structure, classification, and biological roles of biomolecules including carbohydrates, proteins, lipids, nucleic acids, and amino acids.
2	To explain the concept of bioenergetics , free energy changes, energy-rich compounds, and their role in biological systems.
3	To describe the metabolism of carbohydrates , including glycolysis, gluconeogenesis, TCA cycle, glycogen metabolism, and their disorders.
4	To understand the metabolism of lipids and amino acids , their physiological importance, disorders, and biochemical significance.
5	To comprehend nucleic acid metabolism and the processes of genetic information transfer like DNA replication, transcription, translation, and related disorders.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
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CO1	Recall the classification, structure, and biological significance of carbohydrates, proteins, lipids, nucleic acids, and amino acids.	L1
CO2	Explain the principles of bioenergetics and key metabolic pathways of carbohydrates including glycolysis, TCA cycle, gluconeogenesis, HMP shunt, and glycogen	L2
CO3	Understand lipid metabolism including β -oxidation, ketone body formation, fatty acid and cholesterol synthesis, and regulation.	L2
CO4	Describe nucleic acid metabolism and genetic information flow including DNA replication, transcription, translation, and their regulation.	L2
CO5	Explain enzyme classification, kinetics, inhibition, and their diagnostic and therapeutic applications, along with amino acid metabolism and associated disorders.	L2

Syllabus:

Unit-1	Biomolecules	Contact Hours: 8
<ul style="list-style-type: none"> • Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. • Bioenergetics 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 		
Unit -2	Carbohydrate metabolism	Contact Hours: 10
<ul style="list-style-type: none"> • 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 • Hormonal regulation of blood glucose level and Diabetes mellitus • Biological oxidation Electron transport chain (ETC) and its mechanism. • Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers • Biological oxidation Electron transport chain (ETC) and its mechanism. • Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers 		

Unit -3	Lipid metabolism	Contact Hours: 10
<ul style="list-style-type: none"> • β-Oxidation of saturated fatty acid (Palmitic acid) • 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, fatty liver and obesity. • Amino acid metabolism • 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, alpeptonuria, tyrosinemia) • Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline • Catabolism of heme; hyperbilirubinemia and jaundice 		
Unit -4	Nucleic acid metabolism and genetic information transfer	Contact Hours: 10
<ul style="list-style-type: none"> • Biosynthesis of purine and pyrimidine nucleotides • Catabolism of purine nucleotides and 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 		
Unit -5	Enzymes	Contact Hours: 10
<ul style="list-style-type: none"> • 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 		

Books:

Text Books:

1.Principles of Biochemistry by Lehninger.

2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell

References:

- 1.R1. Dr. Kuntal Das, "Biochemistry", Nirali Prakashan, Edition 2022
2. "Biochemistry" by U. Satyanarayana and U. Chakrapani
3. "Lippincott's Illustrated Reviews: Biochemistry" by Denise R. Ferrier

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2										
CO3	3	2										
CO4	3	1										
CO5	3	3		2	1			2		1		1

Program	Bachelor of Pharmacy				Semester II			
Course Name	Biochemistry (Practical)				L	T	P	C

Course Code	BP209P	0	0	4	2
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Course Objectives:

This course ensures that the students understand how:

1	To perform qualitative analysis of carbohydrates, proteins, and lipids.
2	To carry out quantitative estimation of biomolecules.
3	To determine enzyme activity and study factors affecting enzymes.
4	To perform biochemical tests relevant to clinical diagnosis.
5	To develop laboratory skills, analytical ability, and proper documentation practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform qualitative tests for carbohydrates, proteins, and lipids.	L3
CO2	Estimate biomolecules using standard biochemical methods.	L3
CO3	Determine enzyme activity and analyze influencing factors.	L3 & L2
CO4	Interpret results of clinical biochemical tests.	L4
CO5	Maintain laboratory records and follow GLP practices.	L3

Syllabus

BP 209 P	Biochemistry (Practical)	Contact Hours: 4 Hours/week
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1. Qualitative analysis of carbohydrates (glucose, fructose, sucrose, lactose, starch)
2. Qualitative analysis of proteins and amino acids
3. Qualitative analysis of lipids
4. Quantitative estimation of glucose by colorimetry
5. Quantitative estimation of total protein
6. Determination of serum cholesterol
7. Determination of urea
8. Determination of creatinine
9. Study of enzyme activity (e.g., amylase)
10. Effect of temperature and pH on enzyme activity
11. Determination of SGOT/SGPT (Demonstration)
12. Determination of bilirubin (Demonstration)

Books:

Text Books:

T1 Biochemistry by U. Satyanarayana

T2 Textbook of Biochemistry by D.M. Vasudevan

Reference Books:

R1 Harper's Illustrated Biochemistry

R2 Practical Biochemistry Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			

CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Pathophysiology	L	T	P	C
Course Code	BP204T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the Basic Principles of Cell Injury and Adaptation
2	Assess the Process of Inflammation and Its Role in Tissue Repair
3	Examine the Pathophysiology of Neurological and Psychiatric Disorders
4	Investigate Hematological and Endocrine Disorders
5	Compare the Types of Inflammation and Their Clinical Implications

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	Bt Level
CO1	Understand the fundamental concepts of cellular homeostasis, injury, adaptation, and inflammation. Identify causes of cellular injury and the signs of inflammation.	L1 & L2
CO2	Explain the roles of mitochondria, ribosomes, and the nucleus in cellular injury. Apply knowledge to analyze cellular damage and its pathophysiology, especially in respiratory diseases like asthma and COPD.	L2 & L3

CO3	Apply and analyze morphological changes such as necrosis and apoptosis during cell injury. Interpret the impact of electrolyte imbalances on clinical symptoms.	L3 & L4
CO4	Evaluate the clinical management and treatment effectiveness for cardiovascular and autoimmune diseases including rheumatoid arthritis, lupus, and multiple sclerosis.	L5
CO5	Critically assess the mechanisms, progression, and genetic basis of chronic diseases such as cancer, rheumatoid arthritis, and osteoarthritis.	L5

Syllabus:

Unit-1	Basic principles of Cell injury and Adaptation & Basic mechanism involved in the process of inflammation	Contact Hours: 10
<p>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.</p> <p>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</p>		
Unit-2	Cardiovascular System, Respiratory system & Renal system	Contact Hours: 10
<p>Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)</p> <ul style="list-style-type: none"> • Respiratory system: Asthma, Chronic obstructive airways diseases. • Renal system: Acute and chronic renal failure 		
Unit-3	Haematological Diseases, Endocrine system, Nervous system & Gastrointestinal system	Contact Hours: 10

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia		
<ul style="list-style-type: none"> • 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-4	Inflammatory bowel diseases, Disease of bones and joints & Principles of cancer	Contact Hours: 8
Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. <ul style="list-style-type: none"> • Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout • Principles of cancer: classification, etiology and pathogenesis of cancer 		
Unit-5	Infectious diseases & Sexually transmitted diseases	Contact Hours: 7
Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections AIDS, Syphilis, Gonorrhoea		

Books:

Text Books:

T1. Dr Madan Kaushik ,“A Text Book Of Pathophysiology” PV Books

T2. Dr Neeraj Verma and Sunil Singh , “A Text book of Pathophysiology”, Nirali Prakashan

Reference Books:

R1- Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12 th edition; New York; McGraw-Hill; 2011.

R2- 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.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3	2	2	2							1
CO3	2	3		3	2							2
CO4	2	2		2	2	3		2		2	1	2
CO5	2	2		2	2	2	2	3			1	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Computer Applications In Pharmacy	L	T	P	C
Course Code	BP205T	2	0	0	1

Course Objectives:

This course ensures that the students understand how:

1	Comprehend the importance of computer applications in the modern practice of pharmacy, including the impact on patient care, medication safety, and workflow efficiency.
2	Develop the ability to use pharmacy information systems for managing prescriptions, patient records, drug inventories, and medication therapy management (MTM).
3	Understand and apply basic database management techniques to access drug information, patient data, and clinical guidelines, and use these databases to enhance clinical decision-making and pharmaceutical care.
4	Gain proficiency in e-prescribing and managing electronic health records to improve medication accuracy, reduce errors, and optimize patient care in a pharmacy setting.
5	Learn the principles of health informatics, including the integration of digital technologies in healthcare and how they support the role of pharmacists in improving patient outcomes and healthcare efficiency.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall and understand the basic concepts of computer systems, software, and hardware relevant to pharmacy practice.	L1
CO2	Explain and apply the use of software tools such as MS Excel, database systems, and statistical software in pharmaceutical research and patient care.	L2 & L3
CO3	Analyze and design pharmacy-specific computational solutions including databases, algorithms, and decision-support tools.	L4 & L5
CO4	Evaluate and implement advanced computational tools such as molecular modeling, bioinformatics, and data analysis techniques for drug discovery and development.	L5 & L6
CO5	Justify ethical and professional practices in the use of computer systems in pharmacy, including data privacy, system reliability, and patient confidentiality.	L6

Syllabus:

Unit-1		Contact Hours: 06
<p>Number system: Binary number system, Decimal number system, Octal number 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.</p> <p>Concept of Information Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process lifecycle, planning.</p>		
Unit-2		Contact Hours: 06
<p>Web technologies: Introduction to HTML, XML, CSS and Programming languages, Introduction to web servers and Server Introduction to databases, MYSQL, MSACCESS, Pharmacy Drug database.</p>		
Unit-3		Contact Hours: 06
<p>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</p>		
Unit-4		Contact Hours: 06
<p>Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery</p>		
Unit-5		Contact Hours: 06
<p>Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)</p>		

Books:

1. Computer Application in Pharmacy–William E. Fassett–Lea andFebiger,600 South 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 and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. MicrosoftofficeAccess-2003,Application Development Using VBA,SQLServer, DAP and Infopath –CaryN.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

References:

1. "Pharmacy Informatics: Understanding the Role of Information Technology in Pharmacy"
2. "Health Informatics: An Interdisciplinary Approach for Healthcare Professionals"

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	50			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1					1		
CO2	2	3	2		3					2	1	1
CO3	2	3	2	2	3		1		1	2	2	2
CO4	2	2	2	3	3	1	1			1	2	2
CO5					2	2		3	1	2		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Computer Applications In Pharmacy(Practical)	L	T	P	C
Course Code	BP210P	0	0	2	1

Course Objectives:

This course ensures that the students understand how:

1	Comprehend the importance of computer applications in the modern practice of pharmacy, including the impact on patient care, medication safety, and workflow efficiency.
2	Develop the ability to use pharmacy information systems for managing prescriptions, patient records, drug inventories, and medication therapy management (MTM).
3	Understand and apply basic database management techniques to access drug information, patient data, and clinical guidelines, and use these databases to enhance clinical decision-making and pharmaceutical care.
4	Gain proficiency in e-prescribing and managing electronic health records to improve medication accuracy, reduce errors, and optimize patient care in a pharmacy setting.
5	Learn the principles of health informatics, including the integration of digital technologies in healthcare and how they support the role of pharmacists in improving patient outcomes and healthcare efficiency.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall and understand the basic concepts of computer systems, software, and hardware relevant to pharmacy practice.	L1
CO2	Explain and apply the use of software tools such as MS Excel, database systems, and statistical software in pharmaceutical research and patient care.	L2 & L3
CO3	Analyze and design pharmacy-specific computational solutions including databases, algorithms, and decision-support tools.	L4 & L5

CO4	Evaluate and implement advanced computational tools such as molecular modeling, bioinformatics, and data analysis techniques for drug discovery and development.	L5 & L6
CO5	Justify ethical and professional practices in the use of computer systems in pharmacy, including data privacy, system reliability, and patient confidentiality.	L6

BP 210P	Computer Applications In Pharmacy(Practical)	Contact Hours: /02 hr week
<ol style="list-style-type: none"> 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 		

Syllabus:

Books:

1. Computer Application in Pharmacy–William E. Fassett–Lea andFebiger,600 South 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 and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. MicrosoftofficeAccess-2003,Application Development Using VBA,SQLServer, DAP and Infopath –CaryN.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

References:

1. "Pharmacy Informatics: Understanding the Role of Information Technology in Pharmacy"
2. "Health Informatics: An Interdisciplinary Approach for Healthcare Professionals"

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	2hr	2.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	2hr	2.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	30mins	3			MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	2hr	15			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1					1		
CO2	2	3	2		3					2	1	1
CO3	2	3	2	2	3		1		1	2	2	2
CO4	2	2	2	3	3	1	1			1	2	2
CO5					2	2		3	1	2		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester II			
Course Name	Environmental Sciences	L	T	P	C

Course Code	BP206T	3	0	0	3
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Course Objectives:

This course ensures that the students understand how:

1	Understand the multidisciplinary nature of environmental studies.
2	Identify and analyze environmental problems both natural and human-made
3	Develop an attitude of concern for the environment.
4	Participate in environmental protection and improvement initiatives.
5	Acquire skills to help individuals identify and solve environmental problems.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Students will explain the scope, importance, and relevance of environmental studies in pharmacy, and describe key environmental concepts and ecosystems.	L1 & L2
CO2	Students will analyze the use and status of natural resources, assess their sustainable utilization, and suggest conservation strategies.	L2 & L5
CO3	Students will examine biodiversity and ecosystems, identify threats, and propose effective conservation measures for maintaining ecological balance.	L2, L3 & L5
CO4	Students will evaluate types and sources of pollution, investigate their effects on health and environment, and recommend appropriate mitigation strategies.	L1, L5 & L6
CO5	Students will assess environmental laws and population dynamics, and design sustainable solutions for environmental and social issues in pharmacy practice.	L2 & L5

Syllabus

Unit-1	The Multidisciplinary Nature of Environmental Studies	Contact Hours: 10
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<ul style="list-style-type: none"> • Definition, scope, and importance. • Need for public awareness • Renewable and non-renewable resources. • Detailed study of forest, water, mineral, food, energy, and land resources. • Role of individuals in conservation and equitable use of resources. 		
Unit-2	Ecosystems	Contact Hours: 10
<ul style="list-style-type: none"> • Concept, structure, and function of ecosystems. • Types of ecosystems: Forest, grassland, desert, and aquatic ecosystems. 		
Unit-3	Environmental Pollution	Contact Hours: 10
<ul style="list-style-type: none"> • Air Pollution, Water Pollution ,Soil Pollution 		

Suggested Books:

Text Books:

T1 Textbook of Environmental Studies for Undergraduate Courses" By Erach Bharucha

T2 Environmental Studies: From Crisis to Cure by Rajagopalan R.

T3 Fundamentals of Environmental Studies" by Mahua Basu and S. Xavier

Reference Books:

R1 Principles of Environmental Science: Inquiry and Applications" By William P. Cunningham and Mary Ann Cunningham

R2 Environmental Studies" by Benny Joseph

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1

Comprehensive Exam	<input checked="" type="checkbox"/>	2hr	50			Traditional	Levels 1 to 5
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Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2						2			1		1
CO2	2	2	2		2	1	3			1		2
CO3	2	2				1	3					2
CO4	2	3		2	2	2	3	2		2	1	3
CO5	2	2				2	3	3	2	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical Organic Chemistry –II	L	T	P	C
Course Code	BP 301 T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Shall be able to write the structure, name, synthesis, and the reactions of the aromatic compounds like benzene, naphthalene, anthracene, and cycloalkanes (cyclopropane and cyclobutene).
2	Able to compare the reactivity of organic compounds.
3	Understand the concept of resonance.
4	Discuss chemistry of fats and oils.
5	Understand analytical constants' applications like acid value, saponification value, and ester value useful in the quality assurance of oils and fats.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand the structure of benzene and the concept of aromaticity; Analyze electrophilic substitution reactions (nitration, sulphonation, halogenation, Friedel-Crafts).	L2 & L4
CO2	Evaluate the effect of substituents on reactivity and orientation in mono-substituted benzene, phenols, aromatic acids, and amines.	L2 & L5
CO3	Understand acidity/basicity and perform qualitative tests of phenols, aromatic acids, and amines; Apply synthetic uses of aryl diazonium salts.	L1, L2 & L3
CO4	Analyze and evaluate analytical constants of oils (acid value, saponification value, ester value, iodine value, acetyl value, RM value) and their significance.	L2, L4 & L5
CO5	Understand the synthesis, reactions, and medicinal uses of polynuclear hydrocarbons and related compounds (naphthalene, anthracene, phenanthrene, etc.); Explain cycloalkane stability theories.	L1 & L2

Syllabus:

Unit-1	Benzene and its derivatives	Contact Hours: 10
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Benzene and its derivatives		
<p>A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule.</p> <p>B. Reactions of benzene - nitration, sulphonation, halogenation reactivity, Friedel-crafts alkylation- reactivity, limitations, Friedel-crafts acylation.</p> <p>C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction.</p> <p>D. Structure and uses of DDT, Saccharin, BHC and Chloramine</p>		
Unit-2	Phenols, Aromatic Amines & Aromatic Acids	Contact Hours: 10
<p>Phenols: Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthol's.</p> <p>Aromatic Amines: Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts.</p> <p>Aromatic Acids: Acidity, effect of substituents on acidity and important reactions of benzoic acid.</p>		
Unit-3	Fats and oils & Analytical constants	Contact Hours: 10
<p>Fatty acids – reactions</p> <p>Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.</p> <p>Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.</p>		
Unit-4	Polynuclear hydrocarbons	Contact Hours: 8
<p>Synthesis, reactions</p> <p>Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.</p>		
Unit-5	Cyclo alkanes	Contact Hours: 7
<p>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</p>		

Books:

Text Books:

1. Text book of Pharmaceutical Organic Chemistry II by Jain and Others Delhi, Nirali Publication 2018 Volume II.
2. Text book of Pharmaceutical Organic Chemistry II by DR. Bothara G K Delhi, Nirali Publication 2018 Volume II

References:

1. Organic Chemistry by BAML and BAML.
2. Pharmaceutical Organic Chemistry-II by Dr.K.S.Jain, Dr.P.B.Miniyar, Dr.L.V.GNarrund

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3	2									
CO3	3	3	2		1			1				1
CO4	3	2	2	2	2	1	2	1		1	1	2
CO5	3	2	1	1			2	1		1	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical organic Chemistry-II (Practical)	L	T	P	C
Course Code	BP305P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform systematic qualitative analysis of organic compounds containing multiple functional groups.
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2	To carry out organic synthesis reactions relevant to pharmaceutical compounds.
3	To purify synthesized compounds using standard laboratory techniques.
4	To determine physical constants and assess purity of compounds.
5	To develop analytical and interpretation skills in organic chemistry experiments.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform systematic qualitative analysis of unknown organic compounds.	L3
CO2	Carry out organic synthesis reactions using standard procedures.	L3
CO3	Purify synthesized compounds by recrystallization and distillation.	L3 & L2
CO4	Determine melting point and assess purity using TLC.	L4
CO5	Interpret reaction mechanisms and experimental results.	L3

Syllabus

BP 305P	Pharmaceutical organic Chemistry-II (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Systematic qualitative analysis of organic compounds containing more than one functional group 2. Organic synthesis preparations such as: <ul style="list-style-type: none"> • Preparation of sulphanilamide • Preparation of benzocaine • Preparation of phenytoin • Preparation of barbituric acid 3. Determination of melting point of synthesized compounds 4. Purification by recrystallization 5. Thin Layer Chromatography (TLC) for purity check 6. Determination of percentage yield 7. Interpretation of reaction mechanisms (viva-based discussion) 		

Books:

Text Books:

T1 Organic Chemistry by Morrison & Boyd
 T2 Practical Organic Chemistry by A.I. Vogel
 T3 Organic Chemistry by I.L. Finar

Reference Books:

R1 Advanced Practical Organic Chemistry by J. Leonard
 R2 Organic Chemistry by B.S. Bahl & Arun Bahl

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Physical Pharmaceutics-I	L	T	P	C
Course Code	BP302T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand various physicochemical properties of drug molecules in the designing the dosage forms.
2	Know the principles of chemical kinetics
3	Discuss stability testing and determination of expiry date of formulations.
4	Demonstrate use of physicochemical properties in the formulation development
5	Perform evaluation of dosage forms.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand solubility expressions and mechanisms of solute-solvent interactions. Analyze the quantitative factors influencing solubility of	L2 & L4
CO2	Apply diffusion principles in biological systems and evaluate solubility of gases and liquids. Apply buffer equations and evaluate	L3 & L5
CO3	Understand and apply Raoult's law, distribution law, and their limitations. Analyze and apply the principles of preparing buffered	L2 & L3
CO4	Analyze physicochemical properties such as refractive index, optical rotation, dielectric constant, dipole moment, and dissociation	L4 & L5
CO5	Apply and measure surface/interfacial tensions, adsorption, HLB scale. Analyze the role of surface-active agents in	L3 & L4

	solubilization/detergency. Understand and classify complexation and protein binding.	
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Syllabus:

Unit-1	Solubility of drugs	Contact Hours: 10
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-2	States of Matter and properties of matter & Physicochemical properties of drug molecules	Contact Hours: 10
<p>States of Matter and properties of matter:</p> <p>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.</p> <p>Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.</p>		
Unit-3	Surface and interfacial phenomenon	Contact Hours: 10
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, detergency, adsorption at solid interface.		
Unit-4	Complexation and protein binding	Contact Hours: 8
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-5	pH, buffers and Isotonic solutions	Contact Hours: 7
Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic		

Books:

Text Books:

1. PhysicalPharmaceutics by C.V.S. Subramanyam.

- Text book of Physical Pharmaceutics I by Jagtap and Others Delhi, Nirali Publication 2019 Volume II.

References:

- Physical Pharmaceutics-I by KHADE AND OTHERS, NIRALI.
- Physical Pharmaceutics-I by Dr.VaibhavkumarA.Jagtap, Md.RageebMd.Usaman, Atish A.Salunkhe, BasawarajBendegumble.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2							
CO2	2	3	2		2							
CO3	2	2	2									
CO4	2	3		3	3							2
CO5	2	3		2	2	2	2					2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Physical Pharmaceutics -II (PRACTICAL)	L	T	P	C
Course Code	BP306P			4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform experiments related to rheology and surface tension.
2	To determine viscosity and study flow properties of liquids and semisolids.
3	To study solubility and partition coefficient of drugs.
4	To perform particle size analysis.
5	To apply physical pharmacy principles in pharmaceutical formulations.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Determine surface tension using stalagmometer.	L3
CO2	Measure viscosity using different viscometers.	L3
CO3	Determine partition coefficient of drugs.	L3
CO4	Perform particle size analysis and interpret results.	L4
CO5	Apply rheological principles to pharmaceutical systems.	L3

Syllabus

BP 306P	Physical Pharmaceutics -II (Practical)	Contact Hours: 4 Hours/week
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1. Determination of surface tension using stalagmometer
2. Determination of viscosity using:
 - Ostwald viscometer
 - Brookfield viscometer
3. Determination of partition coefficient of a drug
4. Determination of solubility of drug at different pH
5. Particle size analysis by sieving method
6. Determination of bulk density and tapped density
7. Determination of angle of repose
8. Study of sedimentation volume of suspensions
9. Determination of flocculation value
10. Study of rheological behavior of pharmaceutical systems

Books:

Text Books:

T1 Physical Pharmacy by Alfred Martin

T2 Physical Pharmaceutics by C.V.S. Subrahmanyam

Reference Books:

R1 Physical Pharmacy and Pharmaceutical Sciences by Patrick Sinko

R2 Pharmaceutical Calculations by Ansel

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			

CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical Microbiology	L	T	P	C
Course Code	BP303T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand methods of identification, cultivation and preservation of various microorganism.
2	To understand the importance and implementation of sterilization in pharmaceutical processing and industry
3	Learn sterility testing of pharmaceutical products.
4	Carried out microbiological standardization of Pharmaceuticals.
5	Understand the cell culture technology and its applications in pharmaceutical industries.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the history, branches, scope, and importance of microbiology. Differentiate between Prokaryotes and Eukaryotes. Describe the ultra-structure and morphological classification of bacteria. Identify nutritional requirements and physical parameters for bacterial growth.	L1 & L2
CO2	Explain bacterial growth curve, methods for isolation and preservation of pure cultures. Discuss cultivation of anaerobes and quantitative measurement of bacterial growth.	L2

CO3	Evaluate the efficiency of various sterilization methods. Describe equipment used in large-scale sterilization and sterility indicators. Perform sterility testing of pharmaceutical products as per IP, BP, and USP. Design aseptic areas and explain contamination control methods.	L3 & L4
CO4	Discuss the morphology, classification, reproduction, and cultivation of fungi and viruses. Explain the classification and mode of action of disinfectants. Describe microbial spoilage and preservation methods in pharmaceutical products. Evaluate microbial stability and explain animal cell culture applications.	L2 & L5
CO5	Describe the principles and methods of microbiological assays and standardization. Assess the effectiveness of antibiotics using appropriate microbiological methods.	L2 & L5

Syllabus:

Unit-1	Introduction, history of microbiology, Introduction to Prokaryotes and Eukaryotes & Study different types of microscopy	Contact Hours: 10
<p>Introduction, history of microbiology, its branches, scope and its importance.</p> <p>Introduction to Prokaryotes and Eukaryotes.</p> <p>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).</p> <p>Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.</p>		
Unit-2	Identification of bacteria using staining techniques & Method of sterilization.	Contact Hours: 10
<p>Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC).</p> <p>Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization.</p> <p>Evaluation of the efficiency of sterilization methods.</p> <p>Equipments employed in large scale sterilization. Sterility indicators.</p>		

Unit-3	Study of morphology, classification, reproduction of Fungi and Viruses, disinfectants & Sterility testing.	Contact Hours: 10
<p>Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.</p> <p>Classification and mode of action of disinfectants</p> <p>Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions.</p> <p>Evaluation of bactericidal & Bacteriostatic.</p> <p>Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.</p>		
Unit-4	Designing of aseptic area- laminar flow, sources of contamination, Microbiological assay	Contact Hours: 8
<p>Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.</p> <p>Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.</p> <p>Assessment of a new antibiotic.</p>		
Unit-5	Types of spoilage, Preservation of pharmaceutical products, Growth of animal cells in culture & Application of cell cultures.	Contact Hours: 7
<p>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.</p> <p>Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.</p> <p>Application of cell cultures in pharmaceutical industry and research.</p> <p>Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.</p> <p>Application of cell cultures in pharmaceutical industry and research.</p>		

Books:**Text Books:**

1. Pharmaceutical Microbiology by N.K.Jain, Vallabh Prakashan, Delhi.
2. Pharmaceutical Microbiology by Kokare and Others.

References:

1. Pharmaceutical Microbiology and Immunology by Kokate CH. Nirali 2017.
2. Pharmaceutical Microbiology by Dr. Kuntal Das.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								1		1
CO2	3	3	2	2								1
CO3	2	3	2	2	2	2		1	1	1		1
CO4	3	2			2	2	2	1				1
CO5	3	2								1	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical Microbiology (Practical)	L	T	P	C
Course Code	BP307P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform sterilization techniques used in pharmaceutical microbiology.
2	To prepare culture media and carry out microbial cultivation.
3	To perform staining techniques for identification of microorganisms.
4	To evaluate antimicrobial activity.
5	To develop aseptic handling skills and laboratory safety practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Prepare and sterilize culture media.	L3
CO2	Perform aseptic transfer and microbial cultivation techniques.	L3
CO3	Conduct staining procedures such as Gram staining.	L3
CO4	Evaluate antimicrobial activity using standard methods.	L4
CO5	Demonstrate good laboratory practices and biosafety measures.	L3

Syllabus

BP 307P	Pharmaceutical Microbiology (Practical)	Contact Hours: 4 Hours/week
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1. Introduction and functioning of microbiology laboratory instruments
2. Preparation of culture media:
 - Nutrient agar
 - Nutrient broth
3. Sterilization techniques:
 - Dry heat sterilization
 - Moist heat sterilization (Autoclave)
4. Aseptic transfer techniques
5. Staining techniques:
 - Simple staining
 - Gram staining
6. Motility determination of microorganisms
7. Determination of microbial growth by turbidity method
8. Evaluation of antimicrobial activity by:
 - Agar diffusion method
 - Cup plate method
9. Determination of Minimum Inhibitory Concentration (MIC) (Demonstration)
10. Sterility testing of pharmaceutical products (Demonstration)

Books:

Text Books:

T1 Pharmaceutical Microbiology by W.B. Hugo & A.D. Russell

T2 Textbook of Microbiology by Ananthanarayan & Paniker

Reference Books:

R1 Prescott's Microbiology

R2 Practical Microbiology Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5

Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical Engineering	L	T	P	C
Course Code	BP304T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To know various unit operations used in Pharmaceutical industries.
2	To understand the material handling techniques.
3	To perform various processes involved in pharmaceutical manufacturing process.
4	To carryout various test to prevent environmental pollution.

5	To appreciate and comprehend significance of plant lay out design for optimum use of resources.
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Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the types and applications of manometers, Reynolds number, Bernoulli's theorem, and energy losses; Describe the principles, construction, and working of flow meters such as orifice meter, Venturi meter, Pitot tube, and Rotameter.	L1 & L2
CO2	Describe the objectives, mechanisms, and laws of size reduction, size separation, and their influencing factors; Explain the working, uses, merits, and demerits of equipment like hammer mill, ball mill, sieve shaker, and cyclone separator.	L1 & L2
CO3	Explain the principles, mechanisms, and applications of heat transfer, evaporation, distillation, drying, and mixing; Apply these principles in pharmaceutical processes and unit operations.	L2 & L3
CO4	Describe the construction, working, and comparative merits/demerits of evaporators, distillation units, dryers, and mixers; Compare solid and liquid mixing mechanisms.	L1, L2 & L4
CO5	Explain the theories, applications, and equipment used in filtration and centrifugation; Apply these principles in practice; Discuss materials used in pharmaceutical plant construction and corrosion prevention methods.	L1, L2 & L3

Syllabus:

Unit-1	Flow of fluids, Size Reduction & Size Separation	Contact Hours: 10
<p>Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitot tube and Rotameter.</p> <p>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.</p> <p>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.</p>		
Unit-2	Heat Transfer, Evaporation & Distillation	Contact Hours: 10

Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.		
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.		
Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation.		
Unit-3	Drying & Mixing	Contact Hours: 10
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.		
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-4	Filtration & Centrifugation	Contact Hours: 8
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.		
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-5	Materials of pharmaceutical plant construction, Corrosion and its prevention	Contact Hours: 7
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 systems.		

Books:

Text Books:

1. "Pharmaceutical Engineering" by K. Sambamurthy, New Age International Publishers.
2. "Pharmaceutical Engineering" by Subramanyam and Setty, Vallabh Prakashan.

Reference Books:

1. "Introduction to Chemical Engineering" by Badger and Banchero, McGraw Hill Education.
2. "Unit Operations of Chemical Engineering" by Warren L. McCabe, Julian C. Smith, Peter Harriott, McGraw Hill Education.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5

Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2							
CO2	3	3	2		2							
CO3	3	2	3		2							2
CO4	3	2	3		2				2		2	2
CO5	3	3	2	2	3	2	2	2	1	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester III			
Course Name	Pharmaceutical Engineering (Practical)	L	T	P	C
Course Code	BP308P			4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform experiments related to size reduction and size separation.
2	To determine efficiency of mixing and blending equipment.
3	To study heat transfer and evaporation processes.

4	To perform filtration and drying operations.
5	To apply engineering principles in pharmaceutical manufacturing.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform size reduction and evaluate particle size distribution.	L3
CO2	Operate mixing and blending equipment.	L3
CO3	Conduct filtration and drying experiments.	L3
CO4	Analyze heat transfer and evaporation processes.	L4
CO5	Interpret engineering data and calculate process efficiency.	L3

Syllabus:

BP 308P	Pharmaceutical Engineering (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Determination of particle size distribution by sieve analysis 2. Size reduction using: <ol style="list-style-type: none"> i. Ball mill ii. Cutter mill 3. Study of mixing using double cone blender 4. Determination of rate of filtration 5. Study of heat transfer using conduction apparatus 6. Determination of evaporation rate using evaporator 7. Study of drying using tray dryer 8. Determination of moisture content 9. Study of fluidized bed dryer (Demonstration) 10. Study of distillation apparatus (Demonstration) 		

Books:

Text Books:

T1 Pharmaceutical Engineering by K. Sambamurthy

T2 Pharmaceutical Engineering by C.V.S. Subrahmanyam

Reference Books:

R1 Unit Operations of Chemical Engineering by McCabe & Smith
 R2 Introduction to Chemical Engineering by Coulson & Richardson

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV
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Course Name	Pharmaceutical Organic Chemistry –II	L	T	P	C
Course Code	BP 401T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the methods of preparation and properties of organic compounds
2	Explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3	Know the medicinal uses and other applications of organic compounds
4	Explain the principles behind chiral and achiral molecules, and how symmetry elements affect molecular chirality.
5	Develop synthetic strategies utilizing these reactions for the preparation of complex organic compounds.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the concepts of chirality, achirality, symmetry, and conformational isomerism in molecules like ethane, n-butane, and cyclohexane. Analyze the resolution of racemic mixtures and evaluate the impact of chirality and	L2 & L4
CO2	Describe the aromaticity, basicity, and reactivity of heterocycles such as pyrrole, furan, thiophene, and pyridine. Illustrate their synthesis and discuss their medicinal uses.	L2 & L3
CO3	Recall and recognize structures and properties of five- and six-membered heterocycles such as pyrazole, imidazole, oxazole, thiazole, pyrimidine,	L1 & L2
CO4	Analyze how structural variations in heterocyclic compounds influence their physicochemical properties and biological activities. Evaluate the synthesis of complex heterocyclic scaffolds for medicinal applications.	L4 & L5
CO5	Define and understand the mechanisms of key organic reactions including Oppenauer oxidation, Dakin reaction, metal hydride reductions (NaBH ₄ ,	L1, L2, L4 & L5

Syllabus:

Unit-1	Stereo isomerism	Contact Hours: 10
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<p>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</p>		
Unit-2	Geometrical isomerism	Contact Hours: 10
<p>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.</p>		
Unit-3	Heterocyclic compounds	Contact Hours: 10
<p>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.</p>		
Unit-4	Synthesis, reactions and medicinal uses	Contact Hours: 8
<p>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.</p>		
Unit-5	Reactions of synthetic importance	Contact Hours: 7
<p>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</p>		

Books:**Text Books:**

T1. Arun Bahl and B.S. Bahl, “A Text book of Advanced Organic Chemistry”, S Chand, Fifth edition 2012.

T2. Ali Mohammad, “Text Book of Pharmaceutical Organic Chemistry”, CBS, 2020

References:

R1. IL Finar , “Organic Chemistry”, Pearson, Seventh Edition 2013.

R2. Jr. Leroy G. Wade, Jan William Simek, et al, “Organic Chemistry”, Pearson , Ninth Edition 2019

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2							
CO2	3	2		2	2	2						
CO3	3	1								1		
CO4	3	3	2	2	2	2	2					2
CO5	3	2		2	3					1		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV
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Course Name	Medicinal Chemistry – I	L	T	P	C
Course Code	BP-402T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the chemistry of drugs with respect to their pharmacological activity
2	Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3	Study the chemical synthesis of selected drug
4	Know the Structural Activity Relationship of different class of drugs
5	Apply the knowledge of cholinergic neurotransmitters and cholinergic blocking agents to treat conditions related to muscarinic and nicotinic receptors .

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the basic physicochemical properties influencing drug action	L1
CO2	Explain the principles of drug metabolism (Phase I & II reactions), and the structure–activity relationship (SAR) of parasympathomimetic agents and adrenergic drugs.	L2
CO3	Apply knowledge of adrenergic and cholinergic systems to interpret the pharmacological effects and clinical uses of sympathomimetic and cholinergic blocking agents.	L3
CO4	Analyze the SAR of adrenergic antagonists, benzodiazepines, and barbiturates to explain their mechanisms of action and sedative–hypnotic effects.	L4
CO5	Evaluate and design appropriate treatment strategies using general anesthetics and anticonvulsants for various patient populations, considering clinical efficacy, safety, and drug interactions.	L5

Syllabus:

Unit-1	Introduction to Medicinal Chemistry, History and development of medicinal chemistry & Drug metabolism	Contact Hours: 10
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<p>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.</p>		
Unit-2	Drugs acting on Autonomic Nervous System, Adrenergic Neurotransmitters & Adrenergic Antagonists	Contact Hours: 10
<p>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, 89 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.</p>		
Unit-3	Cholinergic neurotransmitters, Biosynthesis and catabolism of acetylcholine, Cholinesterase reactivator & Cholinergic Blocking agents	Contact Hours: 10

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, Isoflurophate, 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-4**Drugs acting on Central Nervous System,
Sedatives and Hypnotics, Antipsychotics,
Anticonvulsants****Contact Hours: 8****Drugs acting on Central Nervous System****A. Sedatives and Hypnotics:**

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

Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

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

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

Fluro buterphenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

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

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolindione: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam,

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

Unit-5	Drugs acting on Central Nervous System ,General anesthetics, Narcotic and non-narcotic analgesics	Contact Hours: 7
<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p> <p>Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride.*</p> <p>Narcotic and non-narcotic analgesics</p> <p>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.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p> <p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.</p>		

Books:

Text Books:

T1. Harkishan Singh, V.K. Kapoor, Medicinal and pharmaceutical chemistry, Vallabh Prakashan, 3rd Edition, 2012.

T2. Ashutosh Kar, "Textbook of Medicinal chemistry" New age international publishers, 7th Edition, 2018.

T3. Panchal and Sen, Synthesis in Medicinal Chemistry, Nirali Prakashan 2019 Edition

T4. Razdan B, Medicinal Chemistry, CBS Publisher.

References:

R1. "JOHN AND JOHN" Organic and Medicinal and Pharmaceutical Chemistry, Wolter publisher, editions,2011.

R2. Thomas G, Medicinal Chemistry, Willey Publisher.

R3. Rafele And Others, Foye's Principle of Medicinal Chemistry, Wolter publisher 2020 Edition.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3	2	1									
CO3	2	3	2	1	2	1						
CO4	2	3	2	2	2		1	1				
CO5	2	3	2	2	3	2	1	2	1	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Medicinal Chemistry-I(Practical)	L	T	P	C
Course Code	BP406P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform synthesis of selected drugs and drug intermediates.
2	To understand structure–activity relationship (SAR) through practical exposure.
3	To carry out purification and characterization of synthesized compounds.
4	To determine melting point and percentage yield.
5	To develop laboratory skills relevant to medicinal chemistry.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform synthesis of selected medicinal compounds.	L3
CO2	Purify synthesized compounds by recrystallization.	L3
CO3	Determine melting point and calculate percentage yield.	L3
CO4	Interpret basic structure–activity relationships.	L4
CO5	Demonstrate safe laboratory practices and documentation.	L3

BP 307P	Medicinal Chemistry-I (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Synthesis of Aspirin 2. Synthesis of Paracetamol 3. Synthesis of Benzocaine 4. Synthesis of Phenytoin 5. Synthesis of Barbituric acid 6. Synthesis of Sulphanilamide 7. Determination of melting point of synthesized compounds 8. Determination of percentage yield 9. Thin Layer Chromatography (TLC) for purity assessment 		

Books:

Text Books:

T1 Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry
T2 Medicinal Chemistry by Ashutosh Kar

Reference Books:

R1 Foye's Principles of Medicinal Chemistry
R2 Practical Medicinal Chemistry Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			

CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Physical Pharmaceutics-II	L	T	P	C
Course Code	BP403T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand various physicochemical properties of drug molecules in the designing the dosage forms.
2	Know the principles of chemical kinetics
3	Discuss stability testing and determination of expiry date of formulations.
4	Demonstrate use of physicochemical properties in the formulation development
5	Perform evaluation of dosage forms.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand solubility expressions and mechanisms of solute-solvent interactions; analyze quantitative factors influencing drug solubility.	L2 & L4
CO2	Apply diffusion principles in biological systems; evaluate solubility of gases and liquids in liquids; apply buffer equations and evaluate	L3 & L5
CO3	Understand and apply Raoult's law, distribution law, and their limitations; analyze and apply principles for preparing buffered	L2 & L3

CO4	Analyze and evaluate physicochemical properties such as refractive index, optical rotation, dielectric constant, dipole moment, and	L4 & L5
CO5	Apply and measure surface and interfacial tensions, adsorption at interfaces, and the HLB scale; analyze the role of surface-active agents in solubilization, detergency, and understand complexation and protein binding applications.	L3 & L4

Syllabus:

Unit-1	Colloidal dispersions	Contact Hours: 07
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-2	Rheology and Deformation of solids	Contact Hours: 10
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-3	Coarse dispersion	Contact Hours: 10
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-4	Micromeritics	Contact Hours: 8
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-5	Drug stability	Contact Hours: 7
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		

Books:

Text Books:

1. PhysicalPharmaceutics by C.V.S. Subramanyam.
2. Text book of Physical Pharmaceutics II by Jagtap and Others Delhi, Nirali Publication 2019 Volume II.

References:

1. Physical Pharmaceutics-IIby KHADE AND OTHERS, NIRALI.
2. Physical Pharmaceutics-I by Dr.VaibhavkumarA.Jagtap, Md.RageebMd.Usaman, Atish A.Salunkhe, BasawarajBendegumble.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2							
CO2	2	3	2	2	3	2						
CO3	2	2	2		2							
CO4	2	3		3	3		2	1		1		2
CO5	2	3		2	3	2	2	1		2	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Physical Pharmaceutics-II(Practical)	L	T	P	C
Course Code	BP407P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To evaluate colloidal and coarse dispersion systems.
2	To determine viscosity and study rheological behavior of pharmaceutical systems.
3	To perform micromeritic evaluation of powders.
4	To determine reaction kinetics and stability parameters.
5	To apply physical pharmacy principles in formulation and stability studies

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Evaluate colloidal and suspension systems.	L3
CO2	Determine viscosity and interpret flow behavior.	L3
CO3	Perform micromeritic studies of powders.	L3
CO4	Determine reaction order and calculate rate constants.	L4
CO5	Assess drug stability under accelerated conditions.	L3

BP 407P	Physical Pharmaceutics-II (Practical)	Contact Hours: 4 Hours/week
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Colloidal Dispersions

1. Determination of sedimentation volume and degree of flocculation
 2. Study of protective action of lyophilic colloids
 3. Determination of zeta potential (Demonstration)
-

II. Rheology

4. Determination of viscosity using Ostwald viscometer
 5. Determination of viscosity using Brookfield viscometer
 6. Study of pseudoplastic and dilatant flow behavior
 7. Study of thixotropy
-

III. Coarse Dispersions

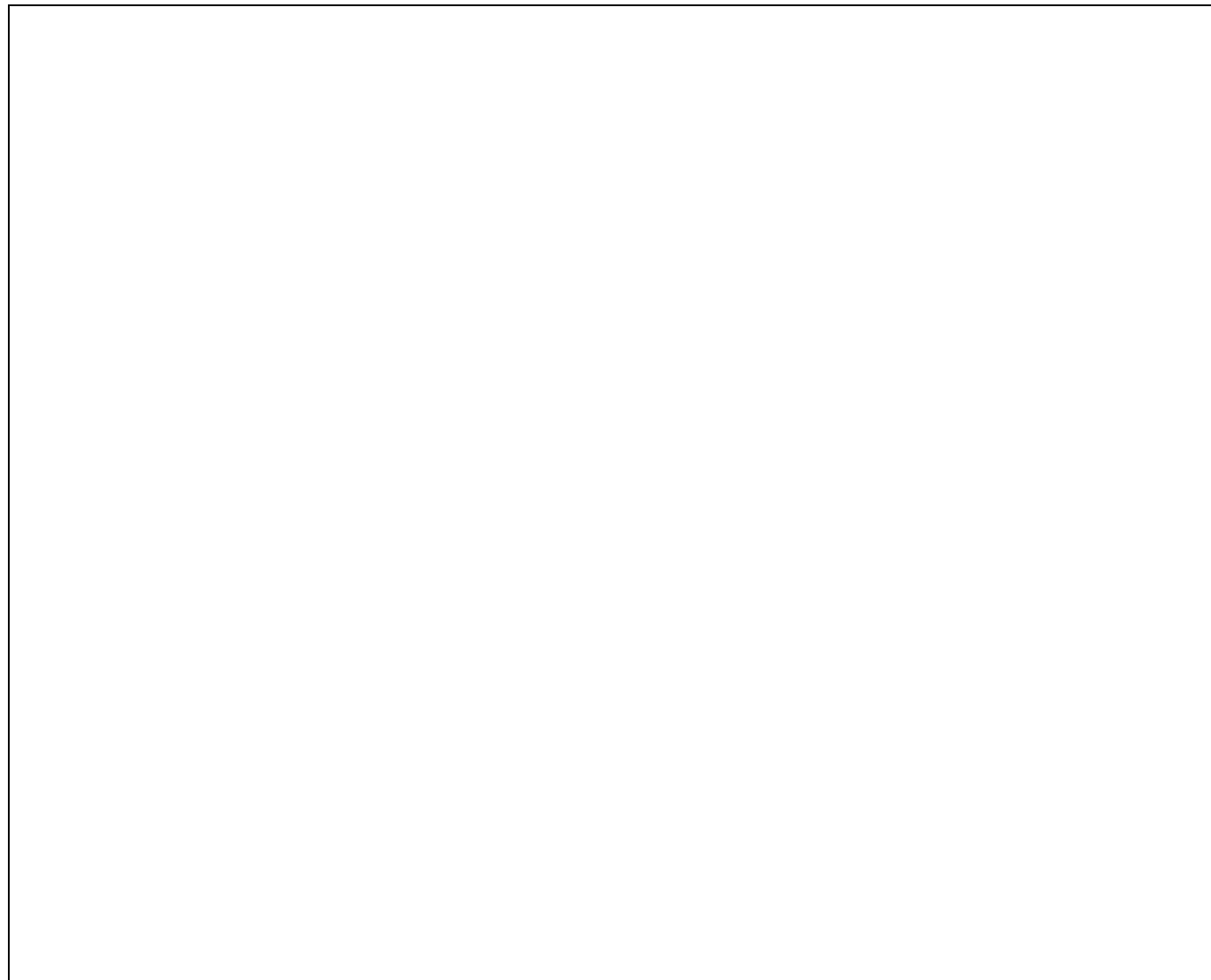
8. Preparation and evaluation of suspension (flocculated & deflocculated)
 9. Preparation and evaluation of emulsion
 10. Determination of HLB value and formulation of emulsion by HLB method
 11. Determination of creaming index
-

IV. Micromeritics

12. Determination of particle size by sieve analysis
 13. Determination of bulk density and tapped density
 14. Determination of angle of repose
 15. Determination of porosity
-

V. Drug Stability & Kinetics

16. Determination of reaction order (zero and first order)
17. Determination of rate constant and half-life
18. Effect of temperature on reaction rate (Arrhenius plot)
19. Accelerated stability study (Demonstration)
20. Photolytic degradation study (Demonstration)



Books:

Text Books

T1 Physical Pharmacy by Alfred Martin

T2 Physical Pharmaceutics by C.V.S. Subrahmanyam

Reference Books

R1 Physical Pharmacy and Pharmaceutical Sciences by Patrick Sinko

R2 Pharmaceutical Calculations by Ansel

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 1 to 5
Test II	☑	4hr	5			Traditional	Levels 1 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Pharmacology I	L	T	P	C
Course Code	BP404T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the pharmacological actions of different categories of drugs
2	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4	Observe the effect of drugs on animals by simulated experiments
5	Appreciate correlation of pharmacology with other bio medical sciences

Course Outcome-

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define basic concepts of pharmacology including key terms like agonists, antagonists, essential drugs, and explain the pharmacokinetic processes of absorption, distribution, metabolism, and excretion.	L1 & L2
CO2	Describe the principles of drug action including receptor mechanisms, receptor theories, tolerance, dependence, and drug interactions (pharmacokinetic and pharmacodynamic).	L1 & L2
CO3	Explain the clinical significance of adverse drug reactions (ADRs) and classify neurotransmitters involved in neurohumoral transmission.	L1 & L2
CO4	Discuss the pharmacological actions and clinical uses of autonomic drugs such as sympathomimetics, parasympathomimetics, neuromuscular blockers, and skeletal muscle relaxants.	L1
CO5	Describe the mechanism of action and clinical applications of general anesthetics, sedatives, hypnotics, and pharmacological therapies for Parkinson's and Alzheimer's diseases.	L1 & L2

Syllabus:

Unit-1	General Pharmacology	Contact Hours: 10
<p>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 noncompetitive), 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</p>		
Unit-2	General Pharmacology	Contact Hours: 10
<p>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, trans membrane enzyme linked receptors, trans membrane 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 pharmacodynamics) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and Pharmacovigilance.</p>		
Unit-3	Pharmacology of drugs acting on peripheral nervous system	Contact Hours: 10
<p>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 anaesthetic agents. f. Drugs used in myasthenia gravis and glaucoma</p>		
Unit-4	Pharmacology of drugs acting on central nervous system	Contact Hours: 8

- a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
- b. General anaesthetics and pre-anaesthetics.
- c. Sedatives, hypnotics and centrally acting muscle relaxants.
- d. Anti-epileptics
- e. Alcohols and disulfiram

Unit-5	Pharmacology of drugs acting on central nervous system	Contact Hours: 7
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- a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manic and hallucinogens.
- b. Drugs used in Parkinson's disease and Alzheimer's disease.
- c. CNS stimulants and nootropics.
- d. Opioid analgesics and antagonists
- e. Drug addiction, drug abuse, tolerance and dependence.

Recommended Books:

Text Book

T1 Rang H.P., Dale M.M., Ritter J.M., Flower R. J., Rangand Dale's Pharmacology,. Churchill Livingstone Elsevier

T2 Katzung B.G., Masters S.B., Trevor A.J., Basic and clinical pharmacology, Tata McGraw-Hill

T3 Goodman and Gilman's, The Pharmacological Basis of Therapeutics

Reference Book

R1 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

R2 MycekM.J,GelnetS.BandPerperM.M.Lippincott'sIllustratedReviews-Pharmacology

R3 K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers(P)Ltd, New Delhi.

Assessment

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
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Test I	☑	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	☑	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	☑		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	☑	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	3	1	2				2				
CO3	3	2			1	1		1				
CO4	2	2	1			2					1	
CO5	2	2		2		2		1		1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy				Semester IV			
Course Name	Pharmacology-I(Practical)				L	T	P	C
Course Code	BP408P				0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	Demonstrate screening methods for drugs affecting cardiovascular and CNS systems.
2	Plot and interpret dose–response curves.
3	To evaluate pharmacological responses using experimental models.

4	To analyze dose–response relationships.
5	To develop ethical awareness in handling experimental animals and alternatives.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Demonstrate screening methods for drugs affecting cardiovascular and CNS systems.	L3
CO2	Plot and interpret dose–response curves.	L3
CO3	Evaluate pharmacological effects using experimental models/software.	L3
CO4	Interpret experimental data statistically.	L4
CO5	Demonstrate ethical and safe laboratory practices.	L3

BP 408P	PharmacologyI (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 1. Study of dose–response curve using isolated tissue preparation 2. Effect of drugs on rabbit eye (mydriatics/miotics) – Demonstration 3. Effect of drugs on blood pressure and heart rate 4. Study of diuretic activity 5. Screening of anti-inflammatory activity 6. Screening of analgesic activity 7. Screening of anti-ulcer activity 8. Screening of anti-epileptic activity 9. Screening of anti-diabetic activity 10. Screening of anti-hypertensive activity 		

Books:

Text Books

T1 Pharmacology by H.P. Rang & M.M. Dale

T2 Essentials of Medical Pharmacology by K.D. Tripathi

Reference Books

R1 Goodman & Gilman's Pharmacological Basis of Therapeutics

R2 Practical Pharmacology Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Pharmacognosy and Phytochemistry-I (Theory)	L	T	P	C
Course Code	BP 405 T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Learn the techniques employed in the cultivation and production of crude drugs
2	Know about the crude drugs, their uses and chemical nature
3	Describe the evaluation techniques for the herbal drugs
4	Carry out the microscopic and morphological evaluation of crude drugs
5	Explain about the secondary metabolites

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe various types and sources (plant, animal, mineral) of crude drugs and explain their pharmacological and therapeutic uses, including key secondary metabolites like alkaloids, glycosides, and tannins.	L1 & L2
CO2	Gain knowledge of cultivation techniques such as soil preparation, propagation, and harvesting, and apply this knowledge to ensure sustainable and ethical crude drug production.	L1 & L3
CO3	Summarize methods for evaluating the quality, purity, and efficacy of herbal drugs, and apply microscopic and organoleptic techniques to differentiate genuine drugs from adulterants.	L2 & L3
CO4	Apply physical, chemical, and biological evaluation techniques for crude drugs and formulate herbal medicines based on standardization parameters.	L3 & L4
CO5	Analyze the biosynthesis and therapeutic role of secondary metabolites in plants and evaluate their potential in drug development and quality assurance of herbal medicines.	L4 & L5

Syllabus:

Unit-1	Introduction to Pharmacognosy; Classification of drugs; Quality control of Drugs of Natural Origin; Quantitative microscopy of crude drugs	Contact Hours: 10
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<p>(a) Definition, history, scope and development of Pharmacognosy</p> <p>(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture</p> <p>(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).</p> <p>(d)Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs</p> <p>(e)Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.</p> <p>(f) lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.</p>		
Unit-2	Cultivation, Collection, Processing and storage of drugs of natural origin; Conservation of medicinal plants	Contact Hours: 10
<p>Cultivation and Collection of drugs of natural origin</p> <p>Factors influencing cultivation of medicinal plants.</p> <p>Plant hormones and their applications.</p> <p>Polyploidy, mutation and hybridization with reference to medicinal plants</p>		
Unit-3	Plant tissue culture	Contact Hours: 7
<p>Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.</p> <p>Applications of plant tissue culture in pharmacognosy.</p> <p>Edible vaccines.</p>		
Unit-4	Pharmacognosy in various systems of medicine; Introduction to secondary metabolites	Contact Hours: 10
<p>Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins</p>		
Unit-5	Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs	Contact Hours: 8
<p>Plant Products:</p> <p>Fibers - Cotton, Jute, Hemp</p> <p>Hallucinogens, Teratogens, Natural allergens</p> <p>Primary metabolites:</p> <p>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:</p> <p>Carbohydrates: Acacia, Agar, Tragacanth, Honey</p> <p>Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).</p> <p>Lipids(Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax</p> <p>Marine Drugs: Novel medicinal agents from marine sources</p>		

Books:

Text Books:

T1:Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale (2007), 37th Edition, NiraliPrakashan, New Delhi.

T2: Mohammad Ali. Pharmacognosy and Phytochemistry, Volume I, CBS Publishers & Distributors, New Delhi.

T3: W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.

T4: Vinod. D. Rangari, Textbook of Pharmacognosy and Phytochemistry, Volume I and Volume II, 2020. Third edition, Pharma career publications.

T5:Textbook of Pharmacognosy and Phytochemistry- I by A.N. Kalia (2021), First edition, CBS Publishers and Distributors,

References:

R1: Remington's Pharmaceutical Sciences.

R2:P.K. Mukherjee and A. Wahile (2006). Perspectives of Safety for Natural Health Products, In: Herbal Drugs- A Twenty first Century Perspectives, edited by Sharma RK & Arora R, (Jaypee Brothers Medicinal Publishers Ltd., New Delhi).

R3:T.E. Wallis (2005). Textbook of Pharmacognosy, fifth edition, CBS Publishers and Distributors Pvt. Ltd

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3	2	2				3	1				
CO3	2	3	2	1	2					1		1
CO4	3	3	2	3	2					1	2	

CO5	2	2		2	3	2	3	3			1	2
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1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester IV			
Course Name	Pharmacognosy and Phytochemistry-I (Practical)	L	T	P	C
Course Code	BP409P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To perform morphological and microscopical evaluation of crude drugs.
2	To identify adulterants in crude drugs.
3	To carry out powder microscopy and quantitative microscopy.
4	To perform extraction and preliminary phytochemical screening.
5	To evaluate crude drugs using physicochemical parameters.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	To perform morphological and microscopical evaluation of crude drugs.	L3
CO2	To identify adulterants in crude drugs.	L3
CO3	To carry out powder microscopy and quantitative microscopy.	L3
CO4	To perform extraction and preliminary phytochemical screening.	L4
CO5	To evaluate crude drugs using physicochemical parameters.	L3

BP 409P	Pharmacognosy and Phytochemistry-I (Practical)	Contact Hours: 4 Hours/week
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I. Morphological and Organoleptic Evaluation

11. Study of crude drugs of natural origin (leaf, bark, root, stem, flower, seed, fruit)
12. Identification of adulterants in crude drugs

II. Microscopy

13. Microscopic study of selected crude drugs
14. Powder microscopy of crude drugs
15. Quantitative microscopy (stomatal number, stomatal index, vein islet number)

III. Physicochemical Evaluation

16. Determination of ash values (total ash, acid insoluble ash)
17. Determination of extractive values
18. Determination of moisture content

V. Phytochemical Evaluation

9. Extraction of crude drugs by maceration/soxhlet method
10. Preliminary phytochemical screening for:
 - Alkaloids
 - Glycosides
 - Tannins
 - Flavonoids
 - Saponins
11. Thin Layer Chromatography (TLC) for identification of phytoconstituents

Books:**Text Books**

- T1 Pharmacognosy by C.K. Kokate
- T2 Textbook of Pharmacognosy by Trease & Evans

Reference Books

R1 Pharmacognosy and Phytochemistry by V.D. Rangari
 R2 Practical Pharmacognosy Manuals (PCI recommended)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Medicinal Chemistry – II	L	T	P	C
Course Code	BP-501T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the chemistry of drugs with respect to their pharmacological activity
2	Understand the fundamental principles and concepts of medicinal chemistry, including the design and development of pharmaceutical agents.
3	Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
4	Know the Structural Activity Relationship of different class of drugs
5	Study the chemical synthesis of selected drug

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the mechanism of action, therapeutic uses, and clinical applications of antihistamines, proton pump inhibitors, and anti-neoplastic agents including antimetabolites.	L1 & L2
CO2	Explain the pharmacological actions, classification, and therapeutic uses of antibiotics, plant products, diuretics, and local anesthetics.	L1 & L2
CO3	Discuss the mechanism of action and therapeutic uses of drugs used in hypertension, hyperlipidemia, congestive heart failure, coagulation disorders (coagulants and anticoagulants).	L2 & L4

CO4	Describe the nomenclature, stereochemistry, metabolism, and mechanism of action of steroids, sex hormones, corticosteroids, and drugs for erectile dysfunction.	L1 & L2
CO5	Explain the mechanism of action and therapeutic uses of thyroid and antithyroid drugs, insulin, and other antidiabetic agents.	L1 & L2

Syllabus:

Unit-1	Antihistaminic agents, Gastric Proton pump inhibitors, Anti-neoplastic agents, Antimetabolites, Antibiotics & Plant products	Contact Hours: 10
<p>Antihistaminic agents: Histamine, receptors and their distribution in the human body. H1-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidaminetartarate, 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 Alkylating agents: Meclorothamine*, Cyclophosphamide, Melphalan, 107 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.</p>		
Unit-2	Anti-anginal & Anti-hypertensive Agents	Contact Hours: 10
<p>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.</p>		

Unit-3	Anti-arrhythmic Drugs, Anti-hyperlipidemic agents, Coagulant & Anticoagulants & Drugs used in Congestive Heart Failure	Contact Hours: 10
<p>Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol.</p> <p>Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol</p> <p>Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel</p> <p>Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.</p>		
Unit-4	Drugs acting on Endocrine system	Contact Hours: 8
<p>Nomenclature, Stereochemistry and metabolism of steroids</p> <p>Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.</p> <p>Drugs for erectile dysfunction: Sildenafil, Tadalafil.</p> <p>Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol</p> <p>Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone</p> <p>Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole</p>		
Unit-5	Antidiabetic agents & Local Anesthetics	Contact Hours: 7
<p>Insulin and its preparations</p> <p>Sulfonyl urea's: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.</p> <p>Biguanides: Metformin.</p> <p>Thiazolidinediones: Pioglitazone, Rosiglitazone.</p> <p>Meglitinides: Repaglinide, Nateglinide.</p> <p>Glucosidase inhibitors: Acrabose, Voglibose.</p> <p>Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.</p> <p>Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.</p> <p>Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.</p> <p>Miscellaneous: Phenacaine, Diperon, Dibucaine. *</p>		

Books:

Text Books:

- T1.** Harkishan Singh, V.K. Kapoor, Medicinal and pharmaceutical chemistry, Vallabh Prakashan, 3rd Edition, 2012.
- T2.** Ashutosh Kar, "Textbook of Medicinal chemistry" New age international publishers, 7th Edition, 2018.

T3. Panchal and Sen, Synthesis in Medicinal Chemistry, Nirali Prakashan 2019 Edition

T4. Razdan B, Medicinal Chemistry, CBS Publisher.

References:

R1. "JOHN AND JOHN" Organic and Medicinal and Pharmaceutical Chemistry, Wolter publisher, editions,2011.

R2. Thomas G, Medicinal Chemistry, Willey Publisher.

R3. Rafele And Others, Foye's Principle of Medicinal Chemistry, Wolter publisher 2020 Edition.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2	2									
CO3	3	3				2						
CO4	3	2						2				
CO5	3	2				2						1

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Industrial Pharmacy-I	L	T	P	C
Course Code	BP502T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Upon successful completion of the course, student able to follow theory,do the practical's Related to Industrial Pharmacy.
2	This subject Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.
3	Upon completion of the course the student shall be able to know the various pharmaceutical dosage forms and their manufacturing techniques.
4	Students will know about various considerations in development of pharmaceutical dosage forms.
5	They acquire knowledge about Formulation of solid, liquid and semisolid dosage forms and their evaluation.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the goals and objectives of preformulation studies. Describe the physicochemical characteristics of drug substances. Apply preformulation principles in the design of solid, liquid oral, and parenteral dosage forms.	L1 & L2
CO2	Explain the formulation, classification, and evaluation of tablets. Discuss tablet coating techniques and quality control tests for tablets and liquid orals.	L2 & L5
CO3	Describe the formulation and manufacturing considerations for syrups, elixirs, suspensions, emulsions, hard and soft gelatin	L1 & L2

	capsules, and cosmetic products.	
CO4	Explain the pelletization process and equipment. Describe formulation and production procedures for parenteral and ophthalmic products. Evaluate the quality control tests and container-closure systems used.	L1, L2 & L5
CO5	Explain the components, formulation, and manufacturing of pharmaceutical aerosols. Discuss the types and selection of packaging materials. Evaluate the stability and quality control tests for packaging materials.	L1 & L5

Syllabus

Unit-1	Preformulation Studies & BCS classification of drugs & its significant	Contact Hours: 7
<p>Introduction to pre-formulation, 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, racemisation, polymerization. Application of pre-formulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.</p>		
Unit-2	Tablets & Liquid orals	Contact Hours: 10
<p>a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments 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. Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia.</p>		
Unit-3	Capsules & Pellets	Contact Hours: 8
<p>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. Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets</p>		
Unit-4	Parenteral Products & Ophthalmic Preparations	Contact Hours: 10
<p>a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity</p>		

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.
 Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions;
 methods of preparation; labeling, containers; evaluation of ophthalmic preparations.

Unit-5	Cosmetics, Pharmaceutical Aerosols & Packaging Materials Science	Contact Hours: 10
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Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

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.

Books:

Text Books:

T1 Theory and Practice of Industrial Pharmacy by Liberman & Lachman

T2 Drug stability - Principles and practice by Cartensen& C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107

T3 Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition

Reference Books:

R1 Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B.Schwartz.

R2 Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		1					1		1
CO2	3	3	2	2	2					1		1
CO3	3	2	2		1					1		1
CO4	3	3	3	2	3	1	1	1	1	1	1	2
CO5	2	1	2		2	1	3			2	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Industrial PharmacyI (Practical)	L	T	P	C
Course Code	BP506P			4	2

Course Objectives:

This course ensures that the students understand how:

1	To provide hands-on training in preformulation, formulation, and evaluation of pharmaceutical dosage forms.
2	To develop skills in preparation of tablets, capsules, injections, eye preparations, and creams.
3	To familiarize students with coating techniques and quality control tests as per IP.
4	To train students in evaluation of finished products and packaging materials.
5	To build practical understanding of GMP, quality, and documentation practices.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform preformulation studies and select suitable excipients for formulations.	L3
CO2	Prepare and evaluate tablets, capsules, injections, eye preparations, and creams using standard methods.	L3
CO3	Apply film coating techniques and understand their purpose in dosage forms.	L3 & L2
CO4	Conduct quality control tests of marketed products and packaging materials as per IP.	L4
CO5	Demonstrate good laboratory practices, documentation, and safe handling of pharmaceutical materials.	L3

Syllabus

BP 506 P	Industrial PharmacyI (Practical)	Contact Hours: 4 Hours/week
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1. Preformulation studies on paracetamol/asparin/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)

Books:

Text Books:

- T1 Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
- T2 Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
- T3 Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman

Reference Books:

- R1 Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005
- R2 Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1			
CO2	3	2	3	1	1				2			
CO3	2	1	2		1				1			
CO4	3	3		2	1			1				
CO5	2					1	1	2	2	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Pharmacology -II (Theory)	L	T	P	C
Course Code	BP503T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understanding the mechanism of drug action and its relevance in the treatment of different diseases helping in making decisions in therapy.
2	Develop skill to demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.
3	The various receptor actions using isolated tissue preparations were understood and applied.
4	The correlation of pharmacology with other biomedical sciences is appreciated.
5	Understand the pharmacological actions and clinical uses of anti-anginal drugs.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the hemodynamics and electrophysiology of the heart and discuss the pharmacology of drugs used in cardiovascular disorders including drugs for congestive heart failure, hypertension, angina, arrhythmia, and shock.	L1 & L2
CO2	Describe the pharmacological actions, mechanisms, therapeutic uses, and side effects of hematinics, coagulants, anticoagulants, fibrinolytics, and antiplatelet agents	L1 & L2
CO3	Analyze the mechanisms and uses of diuretics and anti-diuretics and evaluate various pharmacological agents used in cardiovascular and respiratory disorders.	L2 & L4
CO4	Discuss the pharmacology of NSAIDs, anti-gout, and anti-rheumatic agents with emphasis on mechanism of action, therapeutic applications, and adverse effects.	L1 & L2
CO5	Explain the pharmacology of selected hormones such as anterior pituitary hormones, parathormone, calcitonin, and vitamin D; and describe the principles and procedures of bioassay for important drugs and hormones like insulin, oxytocin, and others.	L1 & L2

Syllabus:

Unit-1	Pharmacology of drugs acting on cardio vascular system	Contact Hours: 10
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-2	Pharmacology of drugs acting on cardio vascular system & Pharmacology of drugs acting on urinary system	Contact Hours: 10
a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.		
Unit-3	Autocoids and related drugs	Contact Hours: 10
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-4	Pharmacology of drugs acting on endocrine system	Contact Hours: 8
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-5	Pharmacology of drugs acting on endocrine system	Contact Hours: 7
a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus.		
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		

Books:

Text Books:

T1 -A concise text book of Pharmacology by N. Murugesh

T2- A Text book of Pharmacology by F. S. K. Barar, S. Chand & company publisher.

T3-Essentials of Medical Pharmacology by K D Tripathi.

References:

R1- Rang and Dale's Pharmacology, Elsevier publisher

R2-Clinical Pharmacy and Therapeutics by Roger Walker, 4th edition, Churchill publisher.

R3-Grabowski Tortora, Principles of anatomy & physiology, 15th edition, Wiley publisher

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2		1						
CO2	3	2		1		1						
CO3	3	3	2	2	2					1		2
CO4	3	2		1		1		1				
CO5	3	2	2	2	1		1	1	1	2	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Pharmacology-II (Practical)	L	T	P	C
Course Code	BP507P			4	2

Course Objectives:

This course ensures that the students understand how:

1	To introduce students to the principles of in-vitro and in-vivo pharmacological experiments and physiological salt solutions.
2	To train students to study the effects of drugs on isolated tissues and whole animals.

3	To develop skills in constructing and interpreting dose–response curves and determining PD ₂ and PA ₂ values.
4	To familiarize students with different bioassay methods such as matching, interpolation, three-point, and four-point assays.
5	To inculcate ethical practices, proper data recording, and scientific reporting in pharmacological experiments.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the principles of in-vitro and in-vivo pharmacological experiments and physiological salt solutions.	L2
CO2	Perform isolated tissue and whole animal experiments to study drug effects on heart, blood pressure, smooth muscle, and inflammation/analgesia models.	L3
CO3	Construct and interpret dose response curves (DRC) and determine PD ₂ and PA ₂ values using standard methods.	L4
CO4	Conduct bioassays of drugs using matching, interpolation, three-point and four-point methods.	L3 & L4
CO5	Demonstrate ethical handling of animals, proper data recording, and scientific reporting of experimental results.	L3

Syllabus

BP 507 P	Pharmacology-II (Practical)	Contact Hours: 4 Hours/week
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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 anococcygeus 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

Books:

Text Books:

- T1 Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
 T2 Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
 T3 Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

Reference Books:

- R1 K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
 R2 Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5

Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	3	2	2	2	1			1	2			
CO3	3	3		2	1					1		
CO4	3	2		2	1				1	1		
CO5	2			1		1	1	3	2	2		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy				Semester V			
Course Name	Pharmacognosy and Phytochemistry-II- Theory				L	T	P	C

Course Code	BP 504 T	3	1	0	4
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Course Objectives:

This course ensures that the students understand how:

1	Know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2	Understand the preparation and development of herbal formulation.
3	Understand the herbal drug interactions
4	Carryout isolation and identification of phytoconstituents.
5	Identify the biosources and therapeutic uses of various secondary metabolites such as alkaloids, phenylpropanoids, flavonoids, steroids, cardiac glycosides, triterpenoids, volatile oils, tannins, resins, and glycosides.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain basic metabolic pathways involved in the formation of secondary metabolites in higher plants, including Shikimic acid, Acetate, and Amino acid pathways.	L1 & L2
CO2	Apply knowledge of radioactive isotopes in biogenetic studies and summarize the classification and composition of secondary metabolites.	L2 & L3
CO3	Identify biosources, therapeutic uses, and commercial applications of secondary metabolites such as alkaloids, flavonoids, steroids, glycosides, and resins.	L1 & L3
CO4	Explain and apply methods for extraction, isolation, estimation, and industrial production of therapeutically important phytoconstituents including menthol, citral, artemisinin, forskolin, and sennosides.	L2 & L4
CO5	Apply and analyze modern phytochemical techniques such as chromatography, spectroscopy, and electrophoresis for isolation and purification of crude drugs.	L3 & L4

Syllabus:

Unit-1	Metabolic pathways in higher plants and their determination.	Contact Hours: 7
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<p>a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.</p> <p>b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.</p>		
Unit-2	General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications.	Contact Hours: 14
<p>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&Naphthaquinones: Gentian, Artemisia, taxus, carotenoids</p> <p>Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids&Naphthaquinones: Gentian, Artemisia, taxus, carotenoids</p>		
Unit-3	Isolation, Identification and Analysis of Phytoconstituents	Contact Hours: 6
<p>a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrrhetic acid &Rutin c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine d) Resins: Podophyllotoxin, Curcumin</p>		
Unit-4	Industrial production, estimation and utilization of the following phytoconstituents	Contact Hours: 10
<p>Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine</p>		
Unit-5	Basics of Phytochemistry	Contact Hours: 8
<p>Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.</p>		

Books:

Text Books:

T1: Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, NiraliPrakashan, New Delhi.

T2: Mohammad Ali. Pharmacognosy and Phytochemistry, Volume I, CBS Publishers & Distributors, New Delhi.

T3: W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.

T4: A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

T5: Vinod. D. Rangari, Textbook of Pharmacognosy and Phytochemistry, Volume I and Volume II, 2020. Third edition, Pharma Career Publications.

References:

R1: Remington's Pharmaceutical Sciences.

R2: P.K. Mukherjee and A. Wahile (2006). Perspectives of Safety for Natural Health Products, In: Herbal Drugs- A Twenty first Century Perspectives, edited by Sharma RK & Arora R, (Jaypee Brothers Medicinal Publishers Ltd., New Delhi).

R3: T.E. Wallis (2005). Textbook of Pharmacognosy, fifth edition, CBS Publishers and Distributors Pvt. Ltd.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3	2		2							
CO3	2	2				1						
CO4	2	2	2	3	3					1		1

CO5	2	3		3	3				1	1	2	2
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1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Pharmacognosy and Phytochemistry (Practical)	L	T	P	C
Course Code	BP508P			4	2

Course Objectives:

This course ensures that the students understand how:

1	To study the morphology, histology, and powder characters of important crude drugs and understand their extraction and detection.
2	To train students in the isolation and identification of active principles from natural sources.
3	To develop skills in chromatographic techniques such as paper chromatography and TLC for separation and analysis.
4	To familiarize students with distillation of volatile oils and detection of phytoconstituents.
5	To provide hands-on experience in chemical tests for analysis of crude drugs and their evaluation.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Identify and evaluate crude drugs based on morphology, histology,	L2 & L3

	and powder characteristics.	
CO2	Isolate and detect active principles such as caffeine, diosgenin, atropine, and sennosides from natural sources.	L3
CO3	Apply chromatographic techniques (paper chromatography and TLC) for separation and analysis of phytoconstituents.	L3 & L4
CO4	Perform distillation of volatile oils and analyze herbal extracts using TLC.	L3
CO5	Conduct chemical tests to analyze and authenticate crude drugs like asafoetida, benzoin, colophony, aloes, and myrrh.	L4

Syllabus

BP 508 P	Pharmacognosy and Phytochemistry (Practical)	Contact Hours: 4 Hours/week
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		

Books:

Text Books:

T1 Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.

T2 Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.

T3 Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007

Reference Books:

R1 Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.

R2 W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	4hr	5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1							1			1
CO2	3	2	2	2	1				1			
CO3	3	3		2	2					1		
CO4	2	1		1	2		1		1			
CO5	3	3		2	1			1		1		1

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester V			
Course Name	Pharmaceutical jurisprudence	L	T	P	C
Course Code	BP505T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	General perspectives, history, evolution of pharmacy law in India
2	Act and Rules regulating the profession and practice of pharmacy in India
3	Important code of ethical guidelines pertaining to various practice standards
4	Brief introduction to the patent laws and their applications in pharmacy
5	Apply ethical principles and professional codes of conduct in making decisions related to patient care, confidentiality, informed consent, and conflicts of interest.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the general principles of pharmaceutical legislation and the historical development of major drug laws including the Pharmacy Act 1948 and Drugs and Cosmetics Act 1940	L2
CO2	Apply the provisions of key regulatory frameworks such as the Narcotic Drugs and Psychotropic Substances Act 1985, Drugs and Magic Remedies Act 1954 and the Biologics Act 1919	L3
CO3	Analyze the roles and responsibilities of pharmacists under various legislations including the Prevention of Cruelty to Animals Act 1960	L4

CO4	Evaluate the impact of the Food Safety and Standards Act (FSSAI), National Pharmaceutical Pricing Authority (NPPA), and related policies on drug quality, pricing, labeling, and public health.	L5
CO5	Formulate ethical decision-making strategies in pharmacy practice based on the Code of Pharmaceutical Ethics and contemporary legal	L6

Syllabus:

UNIT-1	Drugs and Cosmetics Act, 1940 and its rules 1945	Contact Hours: 10
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-2	Drugs and Cosmetics Act, 1940 and its rules 1945	Contact Hours: 10
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 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		
UNIT-3	Pharmacy Act –1948, Medicinal and Toilet Preparation Act –1955 & Narcotic Drugs and Psychotropic substances Act-1985	Contact Hours: 10
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 -4	Study of Salient Features of Drugs and Magic Remedies Act and its rules, Prevention of Cruelty to animals Act-1960 & National Pharmaceutical Pricing Authority	Contact Hours: 8

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) • Nootropic agents

UNIT -5	Pharmaceutical Legislations, Code of Pharmaceutical ethics, Medical Termination of Pregnancy Act , Right to Information Act & Introduction to Intellectual Property Rights (IPR)	Contact Hours: 7
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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)

Books:

Text Books:

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. Clinical Pharmacy and Therapeutics by Roger Walker, 4th edition, Churchill publisher.

Reference Books:

1. Drugs and Cosmetics Act/Rules by Govt. of India publications.
2. Bare Acts of the said laws published by Government. Reference books.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5

Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3	2		1	3		2		1		
CO3	2	3			2	3	2	2				
CO4	2	2	2		2	3	3	2		2	2	2
CO5		2				2		3	3	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	MEDICINAL CHEMISTRY – I	L	T	P	C
Course Code	BP-601T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the importance of drug design and different techniques of drug design.
2	Understand the chemistry of drugs with respect to their biological activity
3	Know the metabolism, adverse effects and therapeutic value of drugs.
4	Know the importance of SAR of drugs.
5	Analyze the SAR of quinolines (like Chloroquine) and evaluate their effectiveness in treating malaria.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the historical background, nomenclature, and classification of β -lactam antibiotics, tetracyclines, aminoglycosides, and quinolines.	L1
CO2	Explain and apply the principles of structure-activity relationships (SAR) and chemical degradation in antibiotics (e.g., β -lactams, tetracyclines, quinolines).	L2 & L3
CO3	Describe the etiology and mechanism of action of antimalarial and antiviral agents and analyze their chemical structures and SAR.	L2 & L4
CO4	Evaluate the therapeutic potential and clinical limitations of broad-spectrum antibiotics (e.g., Chloramphenicol, Clindamycin) and antiviral agents (e.g., Zidovudine, Acyclovir).	L5
CO5	Design a novel antibiotic or modify existing drugs using prodrug approaches, QSAR, and pharmacophore modeling for enhanced efficacy or targeting.	L6

Syllabus:

Unit-1	Antibiotics	Contact Hours: 10
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<p>Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.</p> <p>β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin</p> <p>Tetracyclines: Tetracycline ,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline</p>		
Unit-2	Antibiotics, Antimalarials	Contact Hours: 10
<p>Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.</p> <p>Macrolide: Erythromycin Clarithromycin, Azithromycin.</p> <p>Miscellaneous: Chloramphenicol*, Clindamycin.</p> <p>Prodrugs: Basic concepts and application of prodrugs design.</p> <p>Antimalarials: Etiology of malaria.</p> <p>Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.</p> <p>Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.</p> <p>Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.</p>		
Unit-3	Anti-tubercular Agents, Urinary tract anti-infective agents & Antiviral agents	Contact Hours: 10
<p>Anti-tubercular Agents</p> <p>Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.</p> <p>Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.</p> <p>Urinary tract anti-infective agents</p> <p>Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin</p> <p>Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.</p> <p>Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.</p>		
Unit-4	Antifungal agents, Anti-protozoal Agents, Anthelmintics, Sulphonamides and Sulfones & Folate reductase inhibitors	Contact Hours: 8

Antifungal agents:**Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin.**Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, 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, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.**Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole.**Sulfones:** Dapsone*.

Unit-5	Drug Design & Combinatorial Chemistry	Contact Hours: 7
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Introduction to Drug Design Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis.**Books:****Text Books:****T1.** Harkishan Singh, V.K. Kapoor, Medicinal and pharmaceutical chemistry, Vallabh Prakashan, 3rd Edition, 2012.**T2.** Ashutosh Kar, "Textbook of Medicinal chemistry" New age international publishers, 7th Edition, 2018.**T3.** Panchal and Sen, Synthesis in Medicinal Chemistry, Nirali Prakashan 2019 Edition**T4.** Razdan B, Medicinal Chemistry, CBS Publisher.**References:****R1.** "JOHN AND JOHN" Organic and Medicinal and Pharmaceutical Chemistry, Wolter publisher, editions, 2011.**R2.** Thomas G, Medicinal Chemistry, Willey Publisher.**R3.** Rafele And Others, Foye's Principle of Medicinal Chemistry, Wolter publisher 2020 Edition.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3	3	2	2	2							
CO3	2	2		2	2							
CO4	2	3		2	2	2		2		2	1	2
CO5		2		2	3	2	2	3	2	2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Medicinal Chemistry- III (Practical)	L	T	P	C
Course Code	BP607P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To train students in the preparation of medicinally important drugs and intermediates using standard laboratory methods.
2	To develop skills in the assay and analysis of pharmaceutical drugs using official and standard procedures.
3	To introduce modern synthesis techniques such as microwave irradiation in the preparation of medicinal compounds.
4	To familiarize students with chemical drawing and reaction representation using ChemDraw® software.
5	To develop competence in computational evaluation of physicochemical properties and drug-likeness screening using drug design software and Lipinski's Rule of Five.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Prepare medicinally important drugs and intermediates such as sulphanilamide, coumarin derivatives, chlorobutanol, triphenyl imidazole, tolbutamide, and hexamine using standard laboratory methods.	L3
CO2	Perform assay of drugs such as isoniazid, chloroquine, metronidazole, dapsone, chlorpheniramine maleate, and benzyl penicillin using official/standard methods.	L3 & L4
CO3	Synthesize selected medicinal compounds or intermediates using microwave irradiation technique and evaluate the efficiency of the method.	L3
CO4	Draw chemical structures and reaction schemes accurately using ChemDraw® software.	L3
CO5	Determine and interpret physicochemical properties (logP, cLogP, MR, molecular weight, H-bond donors/acceptors) and perform drug-likeness screening using Lipinski's Rule of Five with drug design software.	L4

Syllabus

BP 607 P	Medicinal Chemistry- III (Practical)	Contact Hours: 4 Hours/week
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I Preparation of drugs and intermediates

- 1 Sulphanilamide
- 2 7-Hydroxy, 4-methyl coumarin
- 3 Chlorobutanol
- 4 Triphenyl imidazole
- 5 Tolbutamide
- 6 Hexamine

II Assay of drugs

- 1 Isonicotinic acid hydrazide
- 2 Chloroquine
- 3 Metronidazole
- 4 Dapsone
- 5 Chlorpheniramine maleate
- 6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Books:**Text Books:**

- T1 Remington's Pharmaceutical Sciences.
T2 Organic Chemistry by I.L. Finar, Vol. II.
T3 The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.

Reference Books:

- R1 Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
R2 Text book of practical organic chemistry- A.I.Vogel.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5

Assignment	<input checked="" type="checkbox"/>		2			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	3			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1					1			
CO2	3	3		2	1					1		
CO3	3	2	2	1	1		1		1			
CO4	2				3					2		
CO5	3	3		2	3					1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Pharmacology III	L	T	P	C
Course Code	BP602T	3	1	0	4

Course objective:

This course ensures that the students understand how:

1	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2	Comprehend the principles of toxicology and treatment of various poisonings
3	Appreciate correlation of pharmacology with related medical sciences.
4	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
5	To understand about the toxicology.

Course Outcome:

CO	Outcome	BT Level
CO1	Understand and explain the pharmacology of drugs acting on the respiratory and gastrointestinal systems.	L1, L2
CO2	Describe the general principles of chemotherapy and classify various antibiotics, including sulfonamides, cotrimoxazole, their mechanisms of action, therapeutic uses, and resistance mechanisms.	L1, L2
CO3	Explain the pharmacodynamics and therapeutic uses of antitubercular, antifungal, antiviral, anthelmintic, antimalarial, and anti-amoebic agents.	L2
CO4	Understand the mechanisms of action and therapeutic relevance of immunostimulants, immunosuppressants, and anticancer drugs, including alkylating agents, antimetabolites, and cytotoxic agents.	L1, L2
CO5	Define and distinguish between acute, subacute, and chronic toxicity, and explain the principles of treatment of poisoning, including antidotes and supportive care.	L1, L2

Syllabus:

Unit-1	Pharmacology of drugs acting on Respiratory system	Contact Hours: 10
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<p>1. Pharmacology of drugs acting on Respiratory system</p> <p>a. Anti -asthmatic drugs</p> <p>b. Drugs used in the management of COPD</p> <p>c. Expectorants and antitussives</p> <p>d. Nasal decongestants</p> <p>e. Respiratory stimulants</p> <p>2. Pharmacology of drugs acting on Gastrointestinal tract</p> <p>a. Antiulcer agents.</p> <p>b. Drugs for constipation and diarrhoea.</p> <p>c. Appetite stimulants and suppressants.</p> <p>d. Digestants and carminatives.</p> <p>e. Emetics and anti-emetics.</p>		
<p>3. Chemotherapy</p> <p>a. General principles of chemotherapy.</p> <p>b. Sulfonamides and cotrimoxazole.</p> <p>c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides</p>		
Unit-3	Chemotherapy	Contact Hours: 10
<p>3. Chemotherapy</p> <p>a. Antitubercular agents</p> <p>b. Antileprotic agents</p> <p>c. Antifungal agents</p> <p>d. Antiviral drugs</p> <p>e. Anthelmintics</p> <p>f. Antimalarial drugs</p> <p>g. Anti-amoebic agents</p>		
Unit-4	Chemotherapy and Immunopharmacology	Contact Hours: 8

3. Chemotherapy

- a. Urinary tract infections and sexually transmitted diseases. .
- b. Chemotherapy of malignancy.

4. Immunopharmacology

- a. Immunostimulants
- b. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

Unit-5	Toxicology and Chronopharmacology	Contact Hours: 7
5. Principles of toxicology <ul style="list-style-type: none"> 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, organophosphorus compound and lead, mercury and arsenic poisoning. 6. Chronopharmacology <ul style="list-style-type: none"> a. Definition of rhythm and cycles. b. Biological clock and their significance leading to chronotherapy. 		

Recommendation Books:**Text Book****T1**

RangH.P.,DaleM.M.,RitterJ.M.,FlowerR.J.,RangandDale’sPharmacology,.ChurchilLivingstoneElsevier

T2 KatzungB.G.,MastersS.B.,TrevorA.J.,Basicandclinicalpharmacology,TataMcGraw-Hill

T3 Goodmanand Gilman’s, The Pharmacological Basis of Therapeutics

Reference Book

R1 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 LippincottWilliams &Wilkins

R2 MycekM.J,GelnetS.BandPerperM.M.Lippincott’sillustratedReviews-Pharmacology

R3 K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers(P)Ltd, New Delhi.

Assessment

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2										
CO3	3	2		2								
CO4	3	2				2		2				
CO5	3	2				2		2				2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Pharmacology-III (Practical)	L	T	P	C
Course Code	BP608P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To train students in dose calculation, experimental design, and data analysis in pharmacological studies.
2	To develop skills in evaluation of pharmacological activities such as antiallergic, anti-ulcer, GI motility, hypoglycemic, and toxicity studies.
3	To familiarize students with biochemical estimations, pyrogen testing, and safety evaluation methods.
4	To introduce pharmacokinetic calculations and biostatistical tools for interpretation of experimental data.
5	To inculcate ethical practices, accurate data recording, and scientific reporting in experimental pharmacology.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Calculate appropriate doses and perform basic experimental procedures in pharmacological studies.	L3
CO2	Evaluate pharmacological activities such as antiallergic, anti-ulcer, GI motility, hypoglycemic, and purgative effects using standard animal models.	L3 & L4
CO3	Perform safety and toxicity studies including pyrogen test, LD ₅₀ determination, and skin/eye irritation tests.	L4
CO4	Estimate biochemical parameters and calculate pharmacokinetic parameters from given experimental data.	L4
CO5	Apply biostatistical methods (t-test, ANOVA, Chi-square, Wilcoxon test) to interpret experimental pharmacology data and present results scientifically.	L4 & L5

Syllabus

BP 608 P	Pharmacology-III (Practical)	Contact Hours: 4 Hours/week
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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)

Books:

Text Books:

- T1 Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
 T2 Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
 T3 Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,

Reference Books:

- R1 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
 R2 K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5

Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1				1			
CO2	3	3	2	2	1			1	1			
CO3	3	3		2		1	1	3				
CO4	3	3		2	1					1		
CO5	2	3		2	1				1	2		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Herbal Drug Technology (Theory)	L	T	P	C
Course Code	BP 603 T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand raw material as source of herbal drugs from cultivation to herbal drug products.
2	To know the WHO and ICH guidelines for evaluation of herbal drugs.
3	To know the herbal cosmetics, natural sweeteners, nutraceuticals.
4	To understand patenting of herbal drugs, GMP.

5	To develop herbal formulations and understand and create innovative cosmeceuticals.
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Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the journey of raw materials from cultivation to the production of finished herbal products and explain sustainable sourcing and ethical practices.	L1, L2
CO2	Summarize WHO and ICH guidelines on standardization, safety, efficacy, and quality control of herbal drugs, and apply theoretical knowledge to design compliant herbal drug products.	L2, L3
CO3	Identify key elements in the formulation of herbal drugs and cosmetics and explain the role of nutraceuticals in health promotion and disease prevention.	L1, L2
CO4	Apply regulatory guidelines for herbal drug development and analyze quality-impacting factors such as environmental conditions, harvesting, and post-harvest processing.	L3, L4
CO5	Evaluate the role of pharmacovigilance in herbal product safety, describe global regulatory frameworks, and apply skills to innovate cosmeceuticals with therapeutic and aesthetic benefits.	L3, L5

Syllabus:

Unit-1	Herbs as raw materials Biodynamic Agriculture Indian Systems of Medicine	Contact Hours: 11
<ul style="list-style-type: none"> ○ 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 ○ Good agricultural practices in cultivation of medicinal plants including Organic farming. ○ Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. ○ Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy ○ Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma. 		
Unit-2	Nutraceuticals Herbal-Drug and Herb-Food Interactions	Contact Hours: 7

<ul style="list-style-type: none"> ○ 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 ○ 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-3	Herbal Cosmetics Herbal excipients Herbal formulations	Contact Hours: 10
<ul style="list-style-type: none"> ○ 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 skincare, hair care and oral hygiene products. ○ Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. ○ Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes 		
Unit-4	Evaluation of Drugs Patenting and Regulatory requirements of natural products Regulatory Issues	Contact Hours: 10
<ul style="list-style-type: none"> ○ WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. ○ Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy ○ Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. ○ Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs. 		
Unit-5	General Introduction to Herbal Industry Schedule T – Good Manufacturing Practice of Indian systems of medicine	Contact Hours: 7
<ul style="list-style-type: none"> ○ 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. ○ 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. 		

Books:

Text Books:

T1: Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale (2007), 37th Edition, NiraliPrakashan, New Delhi.

T2: W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
T3: Textbook of Herbal Drug Technology by NeeleshMalviya and SapnaMalviya, Edition 1st (2019), CBS Publishers and Distributors

References:

R1: Remington’s Pharmaceutical Sciences.

R2:P.K. Mukherjee and A. Wahile (2006). Perspectives of Safety for Natural Health Products, In: Herbal Drugs- A Twenty first Century Perspectives, edited by Sharma RK &Arora R, (Jaypee Brothers Medicinal Publishers Ltd., New Delhi).

R3:T.E. Wallis (2005). Textbook of Pharmacognosy, fifth edition, CBS Publishers and Distributors Pvt. Ltd.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes and Program Outcomes Mapping:

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2			2	3					
CO2	3	2	3		2					1		
CO3	3		2			1				1		
CO4	2	3	2	3	2							2
CO5	2	2		2	3	3	2	3		2	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Herbal Drug Technology (Practical)	L	T	P	C
Course Code	BP609P	0	0	4	2

Course Objectives:

This course ensures that the students understand how:

1	To train students in preliminary phytochemical screening and quantitative estimation of herbal constituents.
2	To develop skills in evaluation of excipients of natural origin and standardization of extracts.
3	To provide hands-on experience in formulation of herbal cosmetics and dosage forms and their evaluation.
4	To familiarize students with pharmacopoeial standards and monograph analysis of herbal drugs.
5	To build competence in quality control and documentation of herbal formulations and raw materials.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Perform preliminary phytochemical screening and determine specific constituents such as alcohol, aldehydes, phenols, and total alkaloids.	L3 & L4
CO2	Evaluate excipients of natural origin and standardize herbal extracts for formulation use.	L3
CO3	Formulate herbal cosmetic products (creams, lotions, shampoos) and evaluate them using standard methods.	L3

CO4	Formulate herbal pharmaceutical dosage forms (syrups, mixtures, tablets) and evaluate them as per Pharmacopoeial requirements.	L3 & L4
CO5	Analyze herbal drug monographs from recent Pharmacopoeias and interpret quality standards.	L2 & L4

Syllabus

BP 609 P	Herbal Drug Technology (Practical)	Contact Hours: 4 Hours/week
<ol style="list-style-type: none"> 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 Pharmacopoeial 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 		

Books:

Text Books:

- T1 Textbook of Pharmacognosy by Trease & Evans.
T2 Essential of Pharmacognosy by Dr.S.H.Ansari
T3 Pharmacognosy & Phytochemistry by V.D.Rangari

Reference Books:

- R1 Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
R2 Pharmacopoeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)

Scheme of Evaluation:

Component	Adopted for this	Duration	Weightage	Date &	Venue	Remarks	Levels
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	Course			Time			
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		2	1					1		1
CO2	3	2	2	1	1		1		1			
CO3	3	2	3	1	1				2			
CO4	3	3	3	2	1				1			
CO5	3	2		1		1		1		1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Biopharmaceutics and Pharmacokinetics	L	T	P	C
Course Code	BP604T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Explore the principles governing the absorption of drugs into the bloodstream after administration & Study how drugs are distributed throughout the body after absorption.
2	Understand the processes by which the body metabolizes drugs, focusing on liver enzymes and phases of metabolism. Understand how formulation factors, such as drug release rate and bioavailability, affect therapeutic efficacy.
3	Understand how different drugs may interact with each other, affecting absorption, metabolism, or elimination.
4	Explore how pharmacokinetic data can be used to optimize drug dosing and therapeutic outcomes.
5	Understand mathematical models to predict drug concentrations in the body over time. Understand concepts like absorption rate, volume of distribution, clearance, and half-life.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the relationship between physicochemical properties of drugs and their bioavailability. Understand the impact of drug formulation and administration routes on therapeutic outcomes.	L1, L2
CO2	Apply pharmacokinetic principles to describe and predict drug concentrations over time using relevant models and equations (e.g., zero/first-order kinetics, half-life, clearance, volume of distribution).	L2, L3
CO3	Analyze factors affecting drug absorption, distribution, metabolism, and excretion (ADME), including solubility, pH, tissue characteristics, and enzyme systems.	L3, L4
CO4	Design dosage regimens and recommend adjustments based on clinical pharmacokinetic data and individual patient characteristics (e.g., organ function, age, weight).	L5
CO5	Assess bioequivalence of generic and branded drugs, interpret related clinical data, and evaluate the significance of therapeutic drug monitoring in optimizing treatment outcomes.	L5

Syllabus:

Unit-1	Introduction to Biopharmaceutics	Contact Hours: 10
<p>Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes</p> <p>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</p>		
Unit-2	Elimination, Bioavailability and Bioequivalence	Contact Hours: 10
<p>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</p> <p>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.</p>		
Unit-3	Pharmacokinetics	Contact Hours: 10
<p>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, $t_{1/2}$, V_d, AUC, K_a, Cl_t and CLR- definitions methods of eliminations, understanding of their significance and application</p>		
Unit-4	Multicompartment models	Contact Hours: 8
<p>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.</p>		
Unit-5	Nonlinear Pharmacokinetics	Contact Hours: 7
<p>a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs</p>		

Books:

Text Books:

T1:Bio Pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmkankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi

T2:Bio Pharmaceutics and Pharmacokinetics, By Dr. Anant Paradkar and Sunil Bakliwal. Nirali Prakashan.

Reference Books:

R1: Remington’s Pharmaceutical Sciences, ByMack Publishing Company, Pennsylvania

R2:Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3	2		2							
CO3	2	3		2	2							
CO4	2	3	2	2	3	2		1	1	2		2
CO5	3	2		2	2	2		2		2		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Pharmaceutical Biotechnology	L	T	P	C
Course Code	BP605T	3	1	0	4

Course objective

This course ensures that the students understand how:

1	Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2	Genetic engineering applications in relation to production of pharmaceuticals
3	Importance of Monoclonal antibodies in Industries
4	Appreciate the use of microorganisms in fermentation technology
5	Understand the Immunoblotting techniques.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the basic concepts of biotechnology and enzyme biotechnology, including methods of enzyme immobilization.	L1 & L2
CO2	Describe cloning vectors, restriction enzymes, DNA ligase, and their applications in genetic engineering for the production of interferons, insulin, and vaccines like Hepatitis B.	L1 & L2
CO3	Explain the types of immunity (humoral and cellular), the structure and functions of immunoglobulins, and the preparation of bacterial, viral vaccines, toxoids, and immunological products.	L1 & L2
CO4	Discuss microbial genetics (transformation, transduction, conjugation, plasmids, transposons) and microbial biotransformation processes along with their industrial applications.	L2 & L4
CO5	Understand fermentation technology including media, sterilization, aeration, fermenter design and control, and explain the production of pharmaceuticals like penicillin, citric acid, Vitamin B12, glutamic acid, and griseofulvin; describe monoclonal antibody production using hybridoma technology and the processing of blood and plasma products.	L1, L2 & L4

Syllabus:

Unit-1	Introduction to Biotechnology	Contact Hours: 10
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<ul style="list-style-type: none"> 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-2	Study of cloning vectors	Contact Hours: 10
<ul style="list-style-type: none"> 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-3	Types of immunity	Contact Hours: 10
<p>Types of immunity- humoral immunity, cellular immunity</p> <ul style="list-style-type: none"> 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 Substitutes. 		
Unit-4	Immuno blotting techniques	Contact Hours: 8
<ul style="list-style-type: none"> 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. 		
Unit-5	Fermentation methods	Contact Hours: 7
<ul style="list-style-type: none"> 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 - penicillin, citric acid, Vitamin B12, Glutamic acid, Griseofulvin. d. Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes. 		

Books:

Text Books:

T1 -Introduction to Pharmaceutical Biotechnology by Jaswant Kaur.

T2. A Textbook of Pharmaceutical Biotechnology by Dr. U. Sai Jyoti.

References:

R1- J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2			2							
CO3	3	2				2		2		1		
CO4	3	2		3	2							2
CO5	3	2	2	2	3		2		2	1	2	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VI			
Course Name	Quality Assurance	L	T	P	C
Course Code	BP 606 T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Demonstrate understanding of the principles of quality assurance and control in pharmaceutical manufacturing processes.
2	Apply regulatory guidelines (e.g., FDA, WHO, ICH) in designing, implementing, and monitoring pharmaceutical quality systems.
3	Evaluate quality control techniques, including analytical methods, validation processes, and documentation standards.
4	Analyze and solve real-world pharmaceutical quality issues using risk management and problem-solving frameworks.

5	Design Standard Operating Procedures (SOPs) and quality audits to improve operational efficiency in pharmaceutical quality assurance.
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Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the fundamental principles of pharmaceutical quality assurance, including quality control, quality management systems, and global regulations.	L1 & L2
CO2	Apply GMP, GLP, and regulatory guidelines in pharmaceutical production and quality assurance processes.	L2 & L3
CO3	Evaluate analytical methods, process validation, and quality audits to ensure product quality, safety, and compliance.	L2 & L5
CO4	Design SOPs and implement Quality Risk Management (QRM) frameworks, incorporating Quality by Design (QbD) and continuous improvement.	L1 & L6
CO5	Critically assess the implications of emerging trends, global regulations, and stability testing of packaging materials on quality systems.	L1 & L5

Syllabus

Unit-1	Quality Assurance and Introduction	Contact Hours: 10
Definition and scope of QA and QC Concept of TQM and QMS Regulatory agencies and guidelines (FDA, WHO, ICH)		
Unit-2	Good Manufacturing Practices (GMP)	Contact Hours: 10
<input type="checkbox"/> Key principles of GMP and GLP <input type="checkbox"/> Facility design, personnel, and documentation practices <input type="checkbox"/> Regulatory inspections and audits		
Unit-3	Validation and Qualification	Contact Hours: 10
<input type="checkbox"/> - Types of validation (process, cleaning, analytical, etc.) <input type="checkbox"/> Equipment and process qualification <input type="checkbox"/> Validation protocols and report		
Unit-4	Quality Risk Management (QRM)	Contact Hours: 8
<input type="checkbox"/> - Risk assessment tools (FMEA, HACCP, etc.)		

<input type="checkbox"/> CAPA and deviation handling <input type="checkbox"/> Out-of-specification results CO4: Implement QRM frameworks		
Unit-5	QbD and Emerging Trends	Contact Hours: 7
<input type="checkbox"/> - Principles and tools of QbD <input type="checkbox"/> Continuous Process Verification (CPV) <input type="checkbox"/> Emerging trends (digital QA, AI, blockchain applications)		
Unit-6	Documentation in QA	Contact Hours: 5
<input type="checkbox"/> Types of documents (SOPs, validation protocols, etc.) <input type="checkbox"/> Documentation practices for audits <input type="checkbox"/> Data integrity and electronic records		

Books:

Text Books:

T1 M. A. Potdar, Pharmaceutical Quality Assurance, Nirali Prakashan, Pune

T2 A text book Pharmaceutical Quality Assurance by O. M. Bagade, Career Publication, Pune”,

Reference Books:

R1 A text book Pharmaceutical Quality Assurance; Nirali Prakashan

R2 M. A. Potdar, Pharmaceutical Quality Assurance, Nirali Prakashan, Pune

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	1											
CO1	3						1					1
CO2	3	2	2		2					1		
CO3	2	3	2	2	3					1		
CO4	2	2	3		3		1	1	2	2	2	2
CO5	2	2			2	2	2	3		3		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VII			
Course Name	Instrumental Methods of Analysis	L	T	P	C
Course Code	BP701T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.
2	Understand the chromatographic separation and analysis of drugs.
3	Perform quantitative & qualitative analysis of drugs using various analytical instruments.
4	Acquire a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique.
5	Know the application of instrumental methods in qualitative and quantitative analysis of drugs.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the principles, electronic transitions, and instrumentation of UV-visible spectroscopy and fluorimetry, including spectral shifts, fluorescence, and types of detectors. Describe and evaluate their analytical applications.	L1, L2, L5
CO2	Apply Beer-Lambert's law in spectrophotometric analysis, including its derivation, deviations, and quantitative applications in titrations and multi-component analysis using UV-visible spectroscopy.	L2, L3
CO3	Explain the principles and instrumentation of IR spectroscopy, flame photometry, atomic absorption spectroscopy, and nephelometry-turbidimetry. Apply these techniques in relevant analytical applications.	L1, L2, L3
CO4	Apply and evaluate the principles, instrumentation, and applications of chromatographic techniques such as paper, thin-layer, column, gas chromatography (GC), and high-performance liquid chromatography (HPLC), including derivatization and temperature programming.	L2, L3, L4, L5
CO5	Describe and apply advanced separation techniques including electrophoresis (paper, gel, capillary), ion exchange, gel filtration, and affinity chromatography. Analyze factors affecting separation and assess advantages and limitations of these methods.	L2, L3, L4

Syllabus:

Unit-1	UV Visible spectroscopy &	Contact Hours: 10
<p>Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.</p> <p>Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.</p> <p>Applications – Spectro-photometric titrations, Single component and multi component analysis</p> <p>Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications</p>		

Unit-2	IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy & Nephelo- turbidometry	Contact Hours: 10
<p>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. Principle, interferences, instrumentation and applications. Principle, interferences, instrumentation and applications. Principle, instrumentation and applications.</p>		
Unit-3	Introduction to chromatography & Electrophoresis	Contact Hours: 10
<p>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. Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.</p>		
Unit-4	Gas chromatography & High performance liquid chromatography	Contact Hours: 8
<p>Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. Introduction, theory, instrumentation, advantages and applications.</p>		
Unit-5	Ion exchange chromatography, Gel chromatography & Affinity chromatography.	Contact Hours: 7
<p>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 applications</p>		

Books:

Text Books:

- T1-Patil and Others, A book of Instrumental Method of Analysis, Nirali Prakashan, Edition 2019 Volume II
T2-Rao Swamy, Instrumental Method Of Analysis, CBS Publisher, 2019 edition.
T3- P C Jain, Instrumental Approach to Analysis, S Chand publisher, 2013 edition.

References:

R1-Gray And Calvin, Instrumental Method of Analysis, CBS Publisher,2018 edition.

R2- Garratt D C, The Quantitative Analysis of Drugs, CBS Publisher,2008 edition.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2					1		2
CO2	3	3	2	2	2					1		2
CO3	3	2		2	2							1
CO4	3	3	2	3	3		1			1		2
CO5	3	3	2	3	3	1	2	1	1	1	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy				Semester VII			
Course Name	Instrumental Methods of Analysis (Practical)				L	T	P	C
Course Code	BP705P						4	2

Course Objectives:

This course ensures that the students understand how:

1	To familiarize students with UV, visible, fluorescence, flame photometry, nepheloturbidimetry, and chromatographic techniques.
2	To train students in quantitative estimation of drugs and inorganic ions using instrumental methods.
3	To develop skills in separation techniques such as paper chromatography, TLC, and column chromatography.
4	To introduce students to advanced analytical instruments like HPLC and Gas Chromatography.
5	To build competence in data interpretation, accuracy, precision, and reporting of analytical results.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Determine absorption maxima and perform quantitative estimations using UV–Visible and colorimetric methods.	L3
CO2	Estimate drugs and analytes using fluorimetry, flame photometry, and nepheloturbidimetry techniques.	L3 & L4
CO3	Perform separation of compounds using paper chromatography, TLC, and column chromatography.	L3
CO4	Interpret analytical data from UV, fluorescence, and flame photometric experiments, including quenching studies.	L4
CO5	Demonstrate working principles and applications of advanced instruments such as HPLC and Gas Chromatography.	L2 & L3

Syllabus

BP 705 P	Instrumental Methods of Analysis (Practical)	Contact Hours: 4 Hours/week
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- 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 nephelo turbidometry
- 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

Books:

Text Books:

- T1 Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B. Schwartz
- T2 Text book of Pharmaceutical Analysis by Kenneth A. Connors
- T3 Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel

Reference Books:

- R1 Spectrophotometric identification of Organic Compounds by Silverstein
- R2 Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	4hr	5			Traditional	Levels 3 to 5
Test II	☑	4hr	5			Traditional	Levels 3 to 5
Assignment	☑		2			Group	Levels 1 to 5
Class Test	☑	30mins	3			20 MCQ	Level 1
Comprehensive Exam	☑	4hr	35			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1	1					1		
CO2	3	3		2	1					1		
CO3	3	2		1	2				1			
CO4	3	3		2	1					1		
CO5	2				3				1	1		2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VII			
Course Name	Industrial Pharmacy II	L	T	P	C
Course Code	BP702T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand the principles and requirements of pilot plant scale-up for different dosage forms.
2	To understand the process of technology transfer from R&D to production as per WHO guidelines.
3	To introduce regulatory affairs and the drug development and approval process.
4	To understand pharmaceutical quality management systems and quality standards.
5	To understand the Indian drug regulatory system and approval procedures for new drugs.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Apply pilot plant scale-up principles for solid, liquid, and semisolid dosage forms in accordance with SUPAC guidelines.	L3
CO2	Implement and document technology transfer activities from R&D to production as per WHO guidelines and quality risk management practices.	L3
CO3	Interpret regulatory requirements related to drug development, clinical studies, and IND/NDA submissions.	L4
CO4	Implement pharmaceutical quality management systems including TQM, QbD, Six Sigma, and OOS handling.	L3
CO5	Comply with Indian drug regulatory requirements including CDSCO procedures and COPP for new drug approval.	L3

Syllabus:

Unit-1	Pilot plant scale up techniques	Contact Hours: 10
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-2	Technology development and transfer	Contact Hours: 10

<p>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</p>		
Unit-3	Regulatory affairs	Contact Hours: 10
<p>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.</p>		
Unit-4	Quality management systems	Contact Hours: 8
<p>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</p>		
Unit-5	Indian Regulatory Requirements	Contact Hours: 7
<p>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.</p>		

Books:

Text Books:

- T1- Agrawal S. S. and Bhatia R. A., *Technology Transfer in Pharmaceutical Industry*, PharmaMed Press, Edition 2018.
T2- Jain A. K. and Jain N. K., *Pharmaceutical Product Development*, CBS Publishers, Edition 2016.
T3- Pisano Douglas J. and Mantus David, *Regulatory Affairs in the Pharmaceutical Industry*, Informa Healthcare, Edition 2015.

References:

- R1- Lachman Leon, Lieberman Herbert A. and Kanig Joseph L., *The Theory and Practice of Industrial Pharmacy*, CBS Publishers, Edition 2013.
 R2- Mitra V. and Khar M. K., *Drug Regulatory Affairs*, B.I. Publications, Edition 2014.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		1				1			
CO2	3	2	3	1	1				2	1	1	
CO3	3	2		1		2		1		1		
CO4	3	2	2	1	1		1	1	1			
CO5	3	1				3	1	2				1

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VII			
Course Name	Pharmacy Practice	L	T	P	C
Course Code	BP 703 T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Know various drug distribution methods in a hospital, appreciate the pharmacy stores management and inventory control.
2	Monitor drug therapy of patient through medication chart review and clinical review, obtain medication history interview and counsel the patients.
3	Identify drug related problems and detect and assess adverse drug reactions.
4	Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states and know pharmaceutical care services.
5	Do patient counseling in community pharmacy; appreciate the concept of Rational drug therapy.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
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CO1	Define the classification and organizational structure of hospitals, including roles of medical staff. Explain the functions and responsibilities of hospital and community pharmacists. Describe the organization, structure, and legal requirements of retail and wholesale drug stores.	L1 & L2
CO2	Identify and classify adverse drug reactions and understand methods for detecting drug interactions. Explain the principles and processes involved in the investigational use of drugs. Interpret clinical laboratory tests, including blood chemistry, hematology, and urinalysis.	L1 & L2
CO3	Explain various drug distribution systems in hospitals. Discuss the purpose, preparation, and revision of a hospital formulary. Organize and manage the functions and policies of the Pharmacy and Therapeutics Committee.	L2 & L3
CO4	Describe the causes of medication non-adherence and explain the pharmacist's role in improving adherence. Conduct patient medication history interviews. Provide drug and poison information services. Perform patient counseling, identifying special cases requiring intervention.	L2 & L3
CO5	Manage community and hospital pharmacy operations, including budgeting, inventory control, purchasing, financial, staff, and infrastructure requirements. Interpret and communicate prescription orders effectively with prescribers and patients. Describe the roles and responsibilities of clinical pharmacists, including drug therapy monitoring.	L2 & L3

Syllabus:

Unit-1	Hospital and it's organization, Hospital pharmacy and its organization & Adverse drug	Contact Hours: 10
<p>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.</p> <p>Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.</p> <p>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 drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.</p> <p>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.</p>		
Unit-2	Drug distribution system in a hospital, Hospital formulary, Therapeutic drug monitoring, Medication adherence, Patient medication history interview & Community pharmacy management	Contact Hours: 10

<p>a) Drug distribution system in a hospital Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labeling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.</p> <p>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.</p> <p>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.</p> <p>d) Medication adherence Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.</p> <p>e) Patient medication history interview Need for the patient medication history interview, medication interview forms.</p> <p>f) Community pharmacy management Financial, materials, staff, and infrastructure requirements.</p>		
Unit-3	Pharmacy and therapeutic committee, information services, counseling, Education and training program in the hospital & Prescribed medication order and communication skill.	Contact Hours: 10
<p>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.</p> <p>b) Drug information services Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.</p> <p>c) Patient counseling Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist .</p> <p>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.</p> <p>e) Prescribed medication order and communication skills Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.</p>		
Unit-4	Preparation and implementation, Clinical Pharmacy & Over the counter (OTC) sales.	Contact Hours: 8
<p>a) Budget preparation and implementation.</p> <p>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.</p> <p>c) Over the counter (OTC) sales Introduction and sale of over the counter, and Rational use of common over the counter medications.</p>		
Unit-5	Drug store management and inventory control, Investigational use of drugs & Interpretation of	Contact Hours: 7

Clinical Laboratory Tests
<p>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</p> <p>b) Investigational use of drugs 151 Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.</p> <p>c) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis.</p>

Books:

Text Books:

1. Dr. Pratibha Nand, Dr. Roop K. Khar. Text book of Hospital and Clinical Pharmacy-Theory and Practical, Birla Publication Pvt. Ltd, Edition 17th 2022-23.
2. KD Triphati, Essential of Medical Pharmacology, Edition-9th Jaypee Brothers
3. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
4. 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.
5. Leon Shargel, Alan H. Mutnik, Paul F. Souney, Larry N. Swanson. Comprehensive Pharmacy Review, 7th edition-Wolters Kluwer, LippincottWilliams& Wilkins
6. Ashish B. Budhrani, Dr. Md. Rageeb Md. Usman, Mrinal, Dr. Prevesh Kumar. A Text book of Pharmacy Practice , PV Books, S Vikash and Company (Medical Publishers)
7. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
8. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributers; 2008.

Reference Books:

1. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea &Febiger; 1986.
2. Scott LT. Basic skills in interpreting laboratory data, 4thed. American Society of Health System Pharmacists Inc; 2009.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1				1				2		
CO2	3	2		2	1			1				1
CO3	2	2	3		2					2	2	1
CO4	2	3	2		2	2		3	1	3		2
CO5	2	2	3		2	2		2	3	3	3	3

Program	Bachelor of Pharmacy	Semester VII
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Course Name	Community Pharmacy and Management	L	T	P	C
Course Code	BP704T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand various approaches for development of novel drug delivery systems.
2	To understand the criteria for selection of drugs
3	Know use of Polymers for the development of Novel drug delivery systems
4	Explain formulation of novel drug delivery systems
5	Conduct evaluation of novel drug delivery systems

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and explain the concepts, terminology, and rationale behind various controlled drug delivery systems. Identify and evaluate their advantages and disadvantages, including diffusion-, dissolution-, and ion exchange-based approaches.	L1 & L2
CO2	Select suitable drug candidates based on physicochemical and biological properties. Classify polymers and explain their role, properties, and applications in controlled release. Describe the concept, techniques, advantages, and applications of microencapsulation.	L2 & L3
CO3	Explain the principles and components of transdermal drug delivery systems (TDDS), including factors affecting skin permeation. Discuss the design, formulation, and evaluation of implantable and osmotic pump-based systems.	L2 & L3
CO4	Explain gastroretentive and nasopulmonary (inhalers, nasal sprays, nebulizers) drug delivery systems. Discuss their formulation strategies, advantages, and limitations.	L1 & L2
CO5	Describe targeted drug delivery systems such as liposomes, niosomes, nanoparticles, monoclonal antibodies, and intrauterine systems. Discuss intraocular drug delivery, ocuserts, and strategies to overcome ocular barriers.	L2 & L3

Syllabus

Unit-1	Controlled drug delivery systems & Polymers	Contact Hours: 10
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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-2	Microencapsulation, Mucosal Drug Delivery system & Implantable Drug Delivery Systems	Contact Hours: 10
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-3	Transdermal Drug Delivery Systems, Gastroretentive drug delivery systems & Nasopulmonary drug delivery system.	Contact Hours: 10
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 gastroadhesive systems and their applications. Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery,		
Unit-4	Targeted drug Delivery	Contact Hours: 8
Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications.		
Unit-5	Ocular Drug Delivery Systems & Intrauterine Drug Delivery Systems	Contact Hours: 7
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.		

Books:

Text Books:

T1 Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

T2 N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).

T3 Vasant V Ranade, Drug delivery systems, CRC Press, New York, Second edition, 2015.

Reference Books:

R1 S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

R2 Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	3	2	2	2					1		1
CO3	3	3	2	2	2	1				1		1
CO4	3	2	1		1	1				1		1
CO5	3	3	2	2	2	1	1	2	1	1	1	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII
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Course Name	Biostatistics and Research Methodology	L	T	P	C
Course Code	BP801T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand basic statistical concepts such as frequency distribution, measures of central tendency, and measures of dispersion.
2	Apply correlation and regression analysis methods to solve pharmaceutical problems.
3	Analyze various probability distributions and parametric tests, including t-tests and ANOVA, in pharmaceutical research.
4	Evaluate non-parametric tests and research design methodologies, including sample size determination and experimental studies.
5	Create factorial designs and response surface methodologies for optimizing pharmaceutical experiments.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define basic statistical terms and describe measures of central tendency and dispersion with pharmaceutical examples. Explain concepts of sampling, errors in hypothesis testing, and types of probability	L1 & L2
CO2	Apply correlation and regression techniques including curve fitting, multiple regression, and error analysis to pharmaceutical datasets. Analyze data using appropriate statistical models.	L3 & L4
CO3	Evaluate and perform parametric (t-test, ANOVA) and non-parametric (Wilcoxon, Mann-Whitney, Kruskal-Wallis, Friedman) tests for analyzing pharmaceutical research data. Justify the choice of test methods based on data characteristics.	L5 & L4
CO4	Design experiments using appropriate methodologies such as factorial designs and response surface methodology. Utilize statistical software (Excel, SPSS, MINITAB, R) to implement regression models and conduct hypothesis testing in industrial and clinical settings.	L6 & L3
CO5	Develop strategies for sample size calculation and power analysis. Construct and interpret various graphs and charts. Prepare research reports and defend experimental designs in pharmaceutical studies.	L6 & L5

Syllabus:

Unit-1	Introduction, Measures of central tendency, Measures of dispersion, Correlation	Contact Hours: 10
<p>Introduction: Statistics, Biostatistics, Frequency distribution</p> <p>Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples</p> <p>Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation Pharmaceuticals examples</p>		
Unit-2	Regression, Probability, Parametric test	Contact Hours: 10
<p>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</p> <p>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</p> <p>Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference</p>		
Unit-3	Non Parametric tests, Introduction to Research, Graphs, Designing the methodology	Contact Hours: 10
<p>Non Parametric tests: Wilcoxon Rank Sum Test, Mann-WhitneyU test, Kruskal-Wallis test, Friedman Test</p> <p>Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism</p> <p>Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph</p> <p>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.</p>		
Unit-4	Regression modeling, Introduction to Practical components of Industrial and Clinical Trials Problems	Contact Hours: 8

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-5	Design and Analysis of experiments	Contact Hours: 7
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Factorial Design: Definition, 22, 23 design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Books:

Text Books:

1. Fundamental of Statistics– Himalaya Publishing House- S.C. Gupta.
2. Design and Analysis of Experiments–PHI Learning Private Limited, R. Pannerselvam.

References:

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2. Design and Analysis of Experiments– Wiley Students Edition, Douglas and C. Montgomery.

Scheme of Evaluation

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	☑	1hr	7.5			Traditional	Levels 3 to 5
Test II	☑	1hr	7.5			Traditional	Levels 3 to 5
Assignment	☑		5			Group	Levels 1 to 5
Class Test	☑	30mins	5			20 MCQ	Level 1
Comprehensive Exam	☑	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO ↓												

CO1	3	2										1
CO2	3	3			2							
CO3	3	2			3							2
CO4	3	2		3	2							2
CO5	2	2		2	2	2		2		1		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Social and Preventive pharmacy (Theory)	L	T	P	C
Course Code	BP802T	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Define the concept of health and disease, and evaluate public health implications.
2	Explain the principles of disease prevention and control, considering social causes and societal impacts.

3	Analyze the relationship between nutrition, balanced diet, and prevention of nutritional deficiencies.
4	Discuss socio-cultural factors influencing health, including the impact of urbanization and poverty.
5	Describe the importance of personal hygiene practices and identify avoidable health habits.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define the concepts of health, disease, and public health. Explain the principles of prevention and control of diseases and the social	L1 & L2
CO2	Describe the relationship between food, nutrition, and health, including balanced diets and nutritional deficiencies. Analyze the impact of socio-cultural factors, urbanization, and poverty on health and disease.	L1 & L4
CO3	Discuss the objectives, functioning, and outcomes of national health programs like HIV/AIDS, TB, leprosy, mother and child health, family welfare, and tobacco control. Evaluate their effectiveness in improving public health.	L2 & L5
CO4	Discuss the importance and methods of improving rural sanitation through community services. Analyze the objectives and impact of the National Urban Health Mission.	L2 & L4
CO5	Create strategies for health promotion and education in schools and communities.	L6

Syllabus:

Unit-1	Concept of health and disease:	Contact Hours: 10
	<ul style="list-style-type: none"> • 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 • Hygiene and health: personal hygiene and health care; avoidable habits 	
Unit -2	Sociology and health Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health	Contact Hours: 10

<ul style="list-style-type: none"> • Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health • 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 -3	National health programs	Contact Hours: 10
<ul style="list-style-type: none"> • HIV AND AIDS control programme, TB, • Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National 158 programme for prevention and control of deafness, • Universal immunization programme, National programme for control of blindness, Pulse polio programme 		
Unit -4	National health intervention programme	Contact Hours: 08
<ul style="list-style-type: none"> • 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 -5	Community services in rural, urban and school health	Contact Hours: 7
<ul style="list-style-type: none"> • Functions of PHC • Improvement in rural sanitation • national urban health mission • Health promotion and education in school 		

Books:

1. Text book of social and preventive pharmacy by Dr. A. Vikneswari, Dr. Vishwas A. T. L., Anjutheswarie S.
2. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications.

References:

Public Health and Community Pharmacy" Author: Jill Jesson, Fiona Bissell, Rebekah L. May
Health Education and Community Pharmacy" Author: P. C. Dandiya, N. K. Kulkarni

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 3

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2						
CO2	3	2	2				2					
CO3	2	3	2			2						1
CO4	2	3	1			3		2		1		
CO5	2					3	1					

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Pharma Marketing Management	L	T	P	C
Course Code	BP 803 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To introduce the fundamental concepts and scope of marketing, with a special focus on the pharmaceutical industry.
2	To analyze consumer behaviour and market segmentation strategies relevant to pharmaceutical products.
3	To explore product and brand management principles, including life cycle, portfolio analysis, and new product development in pharma.
4	To familiarize students with promotional strategies and marketing communication tools,
5	To understand pricing, distribution channels, and the regulatory framework (DPCO, NPPA) governing the pharmaceutical marketing landscape.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define key marketing concepts and explain the scope, functions, and ethical dimensions of pharmaceutical marketing.	L1 & L2
CO2	Differentiate between marketing and selling using pharmaceutical examples. Analyze marketing environments and consumer behavior in pharma markets.	L2 & L3
CO3	Apply principles of segmentation, targeting, and positioning. Design product strategies including life cycle, branding, and labeling for pharmaceutical products.	L3 & L4
CO4	Evaluate and plan promotional strategies using advertising, personal selling, PR, and digital media. Design a promotional budget for a pharma brand.	L4
CO5	Justify distribution strategies and roles of PSRs. Advocate for ethical practices and demonstrate readiness for continuous learning in global pharma marketing.	L5

Unit-1	Marketing and Pharmaceutical market	Contact Hours: 10
<ul style="list-style-type: none">○ Definition, general concepts and scope of marketing○ Distinction between marketing & selling, marketing environment○ Industry and competitive analysis, analysing consumer buying behaviour, industrial buying behaviour.○ 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 and role of market research.		
Unit-2	Product decision	Contact Hours: 10
○ 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-3	Promotion	Contact Hours: 10
○ 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		
Unit-4	Pharmaceutical marketing channels & Professional sales representative (PSR)	Contact Hours: 8
○ Designing channel, channel members, selecting the appropriate channel, conflict in channels ○ Physical distribution management: Strategic importance, tasks in physical distribution management ○ Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, ○ motivating, evaluating, compensation and future prospects of the PSR		
Unit-5	Pricing & Emerging concepts in marketing	Contact Hours: 7
○ Hours 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) ○ Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing		

Syllabus

Books:

Text Books:

T1: Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
T2: Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata McGrawHill, New Delhi.

T3: Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill

T4: Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India

References:

R1: Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)

R2: Ramaswamy, U.S & Nanakamari, S: Marketing Management: Global Perspective, Indian Context, Macmillan India, New Delhi.

R3: Shanker, Ravi: Service Marketing, Excell Books, New Delhi

R4: Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT– Excel series) Excel Publications

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2							2		2		2
CO2	2	3										
CO3	2	2	2		1			1		2	1	
CO4		3	2		2	2		2		3	2	
CO5						2	2	3	2	2		3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Pharmaceutical Regulatory Science	L	T	P	C
Course Code	BP804ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the concept of drug discovery and development
2	Know the regulatory authorities and agencies governing the manufacture and sale of
3	Understand the regulatory filing procedure
4	Concept of Registration procedures for marketing the drug products
5	Preparation of documents for drug development, filing & approval.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand the fundamental concepts of drug discovery and development. Explain the role of regulatory agencies and describe regulatory requirements and approval processes.	L1 & L2
CO2	Describe the country-specific requirements and documentation involved in NDA, IND, ANDA filings, including CTD, eCTD, and drug dossiers. Apply knowledge of various regulatory authority functions (e.g., USFDA, EMA, TGA, CDSCO).	L2 & L3
CO3	Apply and analyze regulatory frameworks for drug development, including FDA reviews, clinical trial protocols, and international guidelines.	L3 & L4
CO4	Evaluate the effectiveness of regulatory guidelines, including CFR, GCP, safety monitoring procedures, and legal frameworks relevant to drug approval.	L5
CO5	Identify resources such as the Orange Book and Purple Book. Justify molecule selection for development based on patent status and regulatory approval pathways.	L1 & L5

Syllabus:

Unit-1	New Drug Discovery and Development	Contact Hours: 10
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Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.		
Unit-2	Regulatory Approval Process	Contact Hours: 10
Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. Regulatory authorities and agencies: Overview of regulatory authorities of India, United States, Europe- an Union, Australia, Japan, Canada (Organization structure and types of applications)		
Unit-3	Registration of Indian drug product in overseas market:	Contact Hours: 10
Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research.		
Unit-4	Clinical trials	Contact Hours: 8
Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee – formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance – safety monitoring in clinical trials		
Unit-5	Regulatory Concepts:	Contact Hours: 7
Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book		

Books:

Text Books:

- T1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan, 4th edition.
- T2. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams.

Reference Books:

- R1. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.
- R2. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
- R3. Drugs: From Discovery to Approval, Second Edition By Rick Ng 164.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	2			2					1		
CO3	3	2	2		2	2					1	1
CO4	3	3	1	2	2	3					1	
CO5	3	2		2	2	3				1	2	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII
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Course Name	Pharmacovigilance	L	T	P	C
Course Code	BP 805 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	Understand the principles and evolution of Pharmacovigilance and identify different types of ADRs and their assessment.
2	Acquire knowledge of global and national drug classification systems and coding dictionaries.
3	Understand vaccine safety monitoring, pharmacovigilance methods, and effective communication strategies.
4	Understand safety data generation during drug development and post-marketing surveillance based on ICH guidelines.
5	Evaluate pharmacogenomic factors and special population safety parameters in Pharmacovigilance

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the historical development, scope, and global importance of pharmacovigilance. Define and classify adverse drug reactions (ADRs) and medication-related events using standard terminologies (e.g., WHO-UMC, MedDRA).	L1 & L2
CO2	Apply causality, severity, seriousness, predictability, and preventability assessment methods to real-case ADRs. Demonstrate skills in detection and reporting of ADRs, including submission of Individual Case Safety Reports (ICSRs) under WHO and PvPI frameworks.	L3
CO3	Evaluate drug and disease classification systems (ATC, INN, ICD, MedDRA, WHO ART) and design pharmacovigilance systems for hospitals, industries, CROs, and national programs.	L4 & L5
CO4	Differentiate passive vs active surveillance methods (e.g., AEFI, sentinel sites, registries) and analyze context-specific strategies for vaccine safety monitoring.	L4
CO5	Critically assess safety data across preclinical, clinical, and post-marketing phases based on ICH guidelines (ICSR, PSUR, DSUR, RMP). Compare Indian regulatory frameworks with global pharmacovigilance standards (CIOMS, ICH) and propose strategies for harmonization.	L5

Syllabus:

Unit-1	<p style="text-align: center;">Introduction to Pharmacovigilance Introduction to adverse drug reactions Basic terminologies used in Pharmacovigilance</p>	Contact Hours: 10
	<ul style="list-style-type: none"> • History and development of Pharmacovigilance • Importance of safety monitoring of Medicine • WHO international drug monitoring programme • Pharmacovigilance Program of India (PvPI) • Definitions and classification of ADRs • Detection and reporting • Methods in Causality assessment • Severity and seriousness assessment • Predictability and preventability assessment • Management of adverse drug reactions • Terminologies of adverse medication related events • Regulatory terminologies 	
Unit-2	<p style="text-align: center;">Drug and disease classification Drug dictionaries and coding in pharmacovigilance Information resources in pharmacovigilance & Establishing pharmacovigilance programme</p>	Contact Hours: 10
	<ul style="list-style-type: none"> • Anatomical, therapeutic and chemical classification of drugs • International classification of diseases • Daily defined doses • International Non-proprietary Names for drugs • WHO adverse reaction terminologies • MedDRA and Standardised MedDRA queries • WHO drug dictionary • Eudra vigilance medicinal product dictionary • Basic drug information resources • Specialised resources for ADRs • Establishing in a hospital • Establishment & operation of drug safety department in industry • Contract Research Organisations (CROs) • Establishing a national programme 	
Unit-3	<p style="text-align: center;">Vaccine safety surveillance Pharmacovigilance methods & Communication in pharmacovigilance</p>	Contact Hours: 10
	<ul style="list-style-type: none"> • Vaccine Pharmacovigilance • Vaccination failure • Adverse events following immunization • Passive surveillance– Spontaneous reports and case series • Stimulated reporting • Active surveillance– Sentinel sites, drug event monitoring and registries 	

	<ul style="list-style-type: none"> • Comparative observational studies– Cross sectional study, case control study and cohort study • Targeted clinical investigations • Effective communication in Pharmacovigilance • Communication in Drug Safety Crisis management • Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media 	
Unit-4	Safety data generation & ICH Guidelines for Pharmacovigilance	Contact Hours: 8
	<ul style="list-style-type: none"> • Preclinical phase • Clinical phase • Post approval phase (PMS) • Organization and objectives of ICH • Expedited reporting • Individual case safety reports • Periodic safety update reports • Post approval expedited reporting • Pharmacovigilance planning • Good clinical practice in pharmacovigilance studies 	
Unit-5	Pharmacogenomics of adverse drug reactions & Drug safety evaluation in special population	Contact Hours: 7
	<ul style="list-style-type: none"> • Genetics related ADR with example focusing PK parameters. • Paediatrics • Pregnancy and lactation • Geriatrics CIOMS • CIOMS Working Groups • CIOMS Form CDSCO (India) and Pharmacovigilance • D&C Act and Schedule Y • Differences in Indian and global pharmacovigilance requirements 	

Books:

Text Books:

- T1: Textbook of Pharmacovigilance by S.K. Gupta, Publisher: Jaypee Brothers, Medical Publishers
T2: Textbook of Pharmacovigilance: Concept and Practice by G.P. Mohanta, P.K. Manna, Pharma Med Press / University-level text
T3: An Introduction to Pharmacovigilance by Patrick Waller, Wiley-Blackwell
T4: Mann's Pharmacovigilance by Elizabeth B. Andrews, Nicholas Moore
Publisher: Wiley
T5: Cobert's Manual of Drug Safety and Pharmacovigilance by Barton Cobert
Publisher: Jones & Bartlett Learning

References:

R1: Practical Drug Safety from A to Z by Barton Cobert, Pierre Biron
 Publisher: Jones and Bartlett Publishers

R2: Stephens' Detection of New Adverse Drug Reactions by John Talbot, Patrick Waller
 Wiley

R3: Textbook of Pharmacoepidemiology by Brian L. Strom, Stephen E. Kimmel, Sean Hennessy,
 Wiley-Blackwell

R4: A Textbook of Clinical Pharmacy Practice: Essential Concepts and Skills by G. Parthasarathi,
 Karin Nyfort-Hansen, Milap C. Nahata, Universities Press / Pharma Book Syndicate

R5: Textbook of Medicine by Yashpal Munjal, Jaypee Brothers Medical Publishers

R6: National Formulary of India (NFI) by Indian Pharmacopoeia Commission (Latest edition
 available on the IPC website or through government distribution)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1		2	1	2	1		1	
CO2	3	1		2	1	2	1	2		2		2
CO3	3	1	3		1			2	1	3	1	
CO4	3	1		2	1	3	1	2			1	2
CO5	3	1	2	3		2	1	1	1	2	2	2

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Quality control and standardization of herbals (Theory)	L	T	P	C
Course Code	BP 806 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To know WHO guidelines for quality control of herbal drugs
2	To know Quality assurance in herbal drug industry
3	To know the regulatory approval process and their registration in Indian and international
4	To appreciate EU and ICH guidelines for quality control of herbal drugs
5	To understand the Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe WHO guidelines for the standardization and quality control of herbal medicines. Explain methods for evaluating safety, efficacy, and purity of herbal drugs.	L1 & L2
CO2	Summarize the principles and importance of Quality Assurance (QA) in herbal drug manufacturing. Apply Good Manufacturing Practices (GMP) and global regulatory guidelines to ensure product consistency and compliance.	L2 & L3
CO3	Identify and explain Indian (e.g., AYUSH) and international regulatory frameworks, including EU and ICH guidelines. Apply these frameworks to ensure compliance in global markets.	L1 & L3
CO4	Analyze documentation requirements such as Common Technical Documents (CTDs) and regulatory dossiers. Evaluate steps involved in registration and marketing authorization of herbal products.	L4 & L5
CO5	Describe preclinical and clinical evaluation processes for herbal drugs. Apply research principles to meet scientific and regulatory expectations for safety and efficacy.	L2 & L3

Syllabus:

Unit-1	Basic tests for drugs	Contact Hours: 10
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<ul style="list-style-type: none"> ○ Pharmaceutical substances, Medicinal plants materials and dosage forms ○ WHO guidelines for quality control of herbal drugs. ○ Evaluation of commercial crude drugs intended for use 		
Unit-2	Quality assurance in herbal drug industry	Contact Hours: 10
<ul style="list-style-type: none"> ○ Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. ○ WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines ○ WHO Guidelines on GACP for Medicinal Plants. 		
Unit-3	EU and ICH guidelines for quality control of herbal drugs	Contact Hours: 10
<ul style="list-style-type: none"> ○ EU and ICH guidelines for quality control of herbal drugs. ○ Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines 		
Unit-4	Stability testing of herbal medicines	Contact Hours: 8
<ul style="list-style-type: none"> ○ Stability testing of herbal medicines. ○ Application of various chromatographic techniques in standardization of herbal products. ○ Preparation of documents for new drug application and export registration ○ GMP requirements and Drugs & Cosmetics Act provisions. 		
Unit-5	Regulatory requirements for herbal medicines	Contact Hours: 7
<ul style="list-style-type: none"> ○ Regulatory requirements for herbal medicines. ○ WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems ○ Comparison of various Herbal Pharmacopoeias. ○ Role of chemical and biological markers in standardization of herbal products 		

Books:

Text Books:

T1: WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999

T2: WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

T3: **Textbook of Herbal Drug Technology by Neelesh Malviya and Sapna Malviya, Edition 1st (2019), CBS Publishers and Distributors**

T4: EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products.

References:

R1: Remington's Pharmaceutical Sciences.

R2: P.K. Mukherjee and A. Wahile (2006). Perspectives of Safety for Natural Health Products, In: Herbal Drugs- A Twenty first Century Perspectives, edited by Sharma RK & Arora R, (Jaypee Brothers Medicinal Publishers Ltd., New Delhi).

R3: Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2	3	2									
CO3	3	3				2						
CO4	2	2		2		2						
CO5	2											

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Computer Aided Drug Design	L	T	P	C
Course Code	BP 807 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand the fundamental stages of drug discovery and development, including both traditional and modern approaches to lead identification such as serendipitous discovery, metabolism-based discovery, and clinical observations.
2	To provide in-depth knowledge of the principles and methods used in structure-activity relationships (SAR) and quantitative structure-activity relationships (QSAR), including classical and 3D-QSAR techniques like Hansch analysis, Free Wilson, COMFA, and COMSIA.
3	To introduce the students to virtual screening tools and molecular modelling techniques such as pharmacophore mapping, drug-likeness screening, molecular docking (rigid, flexible, manual), and de novo drug design.
4	To familiarize students with bioinformatics and cheminformatics tools used in drug design, including the use of ADME and pharmaceutical databases for drug profiling and optimization.
5	To explain the theoretical foundations of molecular mechanics and quantum mechanics in drug modelling, including energy minimization, conformational analysis, and strategies to identify global energy minima.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the stages of drug discovery and development, and explain various methods of lead identification including traditional, metabolic, and clinical approaches.	L3
CO2	Illustrate the concepts of bioisosterism and structure–activity relationships (SAR), and analyze the role of physicochemical parameters in drug design.	L2 & L3
CO3	Apply quantitative structure–activity relationship (QSAR) approaches such as Hansch analysis, Free Wilson analysis, and 3D-QSAR techniques including COMFA and COMSIA.	L3
CO4	Utilize pharmacophore mapping and virtual screening tools for identifying and optimizing potential drug candidates.	L3
CO5	Interpret bioinformatics and cheminformatics databases, and evaluate molecular mechanics and energy minimization methods for conformational analysis in drug design.	L2 & L3

Syllabus:

Unit-1	Introduction to Drug Discovery and Development Lead discovery and Analog Based Drug Design	Contact Hours: 10
<ul style="list-style-type: none"> ○ Stages of drug discovery and development ○ Rational approaches to lead discovery based on traditional medicine ○ Random screening, Non-random screening, serendipitous drug discovery ○ lead discovery based on drug metabolism ○ lead discovery based on clinical observation. ○ Bioisosterism, Classification, Bioisosteric replacement. ○ Any three case studies 		
Unit-2	Quantitative Structure Activity Relationship (QSAR)	Contact Hours: 10
<ul style="list-style-type: none"> ○ SAR versus QSAR, History and development of QSAR, ○ Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient ○ Hammett's substituent constant and Taft's steric constant ○ Hansch analysis, Free Wilson analysis ○ 3D-QSAR approaches like COMFA and COMSIA 		
Unit-3	Molecular Modeling and Virtual Screening Techniques	Contact Hours: 10
<ul style="list-style-type: none"> ○ Virtual Screening Techniques <ul style="list-style-type: none"> ● Drug likeness screening ● Concept of pharmacophore mapping and pharmacophore based Screening, ○ Molecular docking <ul style="list-style-type: none"> ● Rigid docking, flexible docking, manual docking ● Docking based screening. De novo drug design 		
Unit-4	Informatics & Methods in drug design	Contact Hours: 8
<ul style="list-style-type: none"> ○ Introduction to Bioinformatics ○ Introduction to Chemoinformatics. ○ ADME databases ○ Chemical, biochemical and pharmaceutical databases 		
Unit-5	Molecular Modeling	Contact Hours: 7
<ul style="list-style-type: none"> ○ Introduction to molecular mechanics and quantum mechanics ○ Energy Minimization methods and Conformational Analysis, global conformational minima determination 		

Books:**Text Books:**

T1: An Introduction to Medicinal Chemistry by Patrick, Graham L., Oxford University Press (Latest Edition)

T2: Medicinal Chemistry by Ashutosh Kar, New Age International

T3: Organic Chemistry of Medicinal Compounds by V. Alagarsamy, Elsevier India / CBS Publishers

References:

- R1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
 R2. Martin YC. "Quantitative Drug Design" Dekker, New York.
 R3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
 R4. Foye WO "Principles of Medicinal chemistry" Lea & Febiger.
 R5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
 R6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
 R7. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
 R8. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1		1	1	1	1	2	1	1
CO2	3	2	3	2	1	1	1	1	1	2	1	2
CO3	3	2	3	2	1	2	1	1	1	2	1	2
CO4	3	2	3	3	1	1	1	1	1	3	2	3
CO5	3	2	3	3	1	1	1		1	2	1	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Cell and Molecular biology	L	T	P	C
Course Code	BP 808 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To explain the historical development, scope, and foundational principles of cell and molecular biology.
2	To understand the structural and functional organization of prokaryotic and eukaryotic cells, including cell membranes and organelles.
3	To describe the molecular basis of genetic information flow, including the structure and function of DNA, RNA, and the mechanisms of transcription and translation.
4	To analyze the structure and function of proteins, protein synthesis, and the regulation of cellular processes and cell cycles.
5	To evaluate cell signaling pathways and their regulation, with emphasis on receptor mechanisms, protein kinases, and their implications in disease.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Explain the history, fundamental concepts of cell and molecular biology, and differentiate between prokaryotic and eukaryotic cells along with their structural components.	L3
CO2	Illustrate the chemical foundations of cellular function, including biomolecules, biochemical reactions, and cellular reproduction processes such as mitosis and meiosis.	L2
CO3	Explain the structure and functional roles of DNA, RNA, and proteins in the flow of genetic information, including transcription, translation, and protein folding.	L3
CO4	Describe the molecular mechanisms involved in cell cycle regulation and checkpoints, and interpret cellular signaling pathways and their implications in health and disease.	L2
CO5	Describe and evaluate modern genetic tools such as transgenic technologies and	L2

	genomic analysis techniques used in molecular biology research.	
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Syllabus:

Unit-1	Introduction to Cell and Molecular Biology	Contact Hours: 10
	<ul style="list-style-type: none"> ○ Definitions, theory, basics, and applications of Cell and Molecular Biology ○ Historical background and evolution of the field ○ Properties of cells and cell membranes ○ Comparison: Prokaryotic vs. Eukaryotic cells ○ Cellular reproduction ○ Basic chemical foundations and types of cellular chemical reactions ○ 	
Unit-2	DNA and Genetic Information Flow	Contact Hours: 10)
	<ul style="list-style-type: none"> ○ DNA structure and the flow of molecular information ○ DNA functioning and its role in heredity ○ RNA: Structure, types, and functions ○ Mechanisms of transcription and translation 	
Unit-3	Proteins and Cellular Processes	Contact Hours: 10
	<ul style="list-style-type: none"> ○ Proteins: Definition, structure, and biological importance ○ Levels of protein structure and folding ○ Protein synthesis pathways and control ○ Role of proteins in cellular processes ○ Regulation and significance of protein synthesis 	
Unit-4	Genetics and Cell Cycle	Contact Hours: 8
	<ul style="list-style-type: none"> ○ Basic concepts of genetics ○ Transgenics and genomic analysis ○ Cell cycle phases and analysis ○ Mitosis and meiosis ○ Cellular checkpoints and regulatory mechanisms 	
Unit-5	Cell Signaling and Regulation	Contact Hours: 7
	<ul style="list-style-type: none"> ○ Introduction to cell signaling ○ Types of receptors and their mechanisms ○ Overview of signaling pathways (MAPK, JAK-STAT, etc.) ○ Misregulation of signaling pathways in diseases 	

- Role and function of protein kinases

Books:

Text Books:

T1: B.R. Glick and J.J. Pasternak – *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, ASM Press, Washington D.C.

T2: Harvey Lodish et al. – *Molecular Cell Biology*, W.H. Freeman & Co.

T3: Geoffrey M. Cooper & Robert E. Hausman – *The Cell: A Molecular Approach*, Sinauer Associates / Oxford University Press.

T4: Deepti Sharma – *Cell and Molecular Biology*, PharmaMed Press (An Imprint of BSP Books Pvt. Ltd.)

T5: P.S. Verma & V.K. Agarwal – *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, S. Chand Publishing

T6: N.K. Jain – *Pharmaceutical Microbiology*, Vallabh Prakashan

References:

R1: G. Karp – *Cell and Molecular Biology: Concepts and Experiments*, Wiley

R2: Alberts et al. – *Molecular Biology of the Cell*, Garland Science

R3: Bruce Alberts et al. – *Essential Cell Biology*, Garland Science

R4: Malcolm Harris – *Pharmaceutical Microbiology*, Balliere Tindall and Cox

R5: NPTEL Course – *Cell Biology by Prof. Gautam Basu, IIT Bombay*
Available at NPTEL.ac.in (with lecture videos, notes, and quizzes)

R6: AICTE eBooks Portal (ELIS/National Digital Library) – Free access to cell biology texts and molecular biology references via:

➤ <https://ndl.iitkgp.ac.in>

➤ <https://aicte-india.org/education/policy-initiatives/elis>

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1		1	1			2		1
CO2	3	1	2	1	1	1	1			2		2
CO3	3	2	2	2	1	1	1			2	1	2
CO4	3	2	2	2	1	1	1			2	1	3
CO5	3	2	3	2	2	2	1	1	1	3	1	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Cosmetic Science	L	T	P	C
Course Code	BP 809ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand the classification, regulatory definitions, and evolution of cosmetics and cosmeceuticals.
2	To study the structure and functions of skin, hair, and oral cavity in relation to cosmetic applications.
3	To learn the principles of formulation and evaluation of various skin, hair, and oral care cosmetic products
4	To gain knowledge about cosmetic excipients and their roles in different formulations.
5	To explore the use of herbal ingredients in cosmetics and the basic analytical techniques used for quality control.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and classify cosmetic and cosmeceutical products as per Indian and EU regulations, and explain the evolution of cosmeceuticals, quasi drugs, and OTC products.	L1, L2
CO2	Describe the structure and function of skin, hair, and oral cavity, and identify common cosmetic problems with suitable formulation-based solutions.	L2, L3
CO3	Identify and describe the functions of cosmetic excipients and demonstrate formulation principles for skin, hair, and oral care products.	L2, L3
CO4	Differentiate between types of sunscreens, explain the concept of SPF, and evaluate the role of herbal ingredients in cosmetic formulations.	L2, L4
CO5	Apply quality control methods including analytical techniques and BIS specifications in evaluating cosmetic product safety and efficacy.	L3, L4

Syllabus:

Unit-1	Introduction to Cosmetics and Cosmeceuticals	Contact Hours: 10
<input type="checkbox"/> Classification of cosmetic and cosmeceutical products <input type="checkbox"/> Definition of cosmetics as per Indian and EU regulations <input type="checkbox"/> Evolution of cosmeceuticals from cosmetics <input type="checkbox"/> Cosmetics as quasi and OTC drugs <ul style="list-style-type: none"> ▪ Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives ▪ Skin: Basic structure and function <input type="checkbox"/> Hair: Basic structure and hair growth cycle <input type="checkbox"/> Oral Cavity: Common problems associated with teeth and gums		
Unit -2	Formulation Principles of Cosmetic Products	Contact Hours: 10
<ul style="list-style-type: none"> ▪ Principles of formulation and building blocks of skin care products: Face wash, moisturizing cream, cold cream, vanishing cream ▪ Antiperspirants and deodorants – Actives and 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-phenylenediamine-based hair dye ▪ Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth, teeth whitening; mouthwash 		
Unit -3	Herbal Cosmetics and Analysis	Contact Hours: 10
<input type="checkbox"/> Sun protection, classification of sunscreens and SPF <input type="checkbox"/> Role of herbs in cosmetics: Aloe, turmeric, henna, amla, neem, clove <input type="checkbox"/> Analytical cosmetics: BIS specification and analytical methods for shampoo, skin cream, and toothpaste		
Unit -4	Cosmetic Evaluation and Cleansing Agents	Contact Hours: 08
<input type="checkbox"/> Principles of cosmetic evaluation: Sebumeter, corneometer, TEWL, skin color, hair tensile strength, hair combing properties <input type="checkbox"/> Soaps and syndet bars: Evolution and skin benefits		
Unit -5	Cosmetic Conditions and Solutions	Contact Hours: 07
<input type="checkbox"/> Oily and dry skin, causes of dry skin, skin moisturisation <input type="checkbox"/> Basic understanding of comedogenic and dermatitis <input type="checkbox"/> Cosmetic problems of hair and scalp: Dandruff, hair fall <input type="checkbox"/> Cosmetic problems of skin: Blemishes, wrinkles, acne, prickly heat, body odor <input type="checkbox"/> Antiperspirants and deodorants – Actives and mechanism of action		

Books:**Text Books:**

- T1. Cosmetic Science and Technology** – Barel, Paye & Maibach
T2. Harry’s Cosmeticology – J.B. Wilkinson & R.J. Moore
T3. Handbook of Cosmetic Science and Technology – André O. Barel, Marc Paye, Howard I. Maibach
T4. Modern Cosmetics: Ingredients of Natural Origin – Željko Knez, et al.

References:

- R1: Poucher’s Perfumes, Cosmetics and Soaps** – Hilda Butler
R2: Cosmetics: Formulation, Manufacturing and Marketing – E. Flick
R3: Textbook of Cosmetic Formulations – V.A. Ansel
R4: Pharmaceutical Cosmetics and Cosmeceuticals – Peter Elsner, Howard I. Maibach

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Test II	<input checked="" type="checkbox"/>	1hr	7.5			Traditional	Levels 3 to 5
Assignment	<input checked="" type="checkbox"/>		5			Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5			20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75			Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2										
CO3	3											
CO4	3											
CO5	2	3	3									

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Pharmacological Screening Methods	L	T	P	C
Course Code	BP 810 ET	3	1	0	4

Course Objectives:

This course ensures that the students understand how:

1	To understand the ethical guidelines (CPCSEA, OECD) for the use and care of laboratory animals in research.
2	To acquire knowledge about the selection, handling, breeding, and administration techniques for laboratory animals.
3	To learn and apply various preclinical screening models for evaluating the pharmacological activities of drug candidates across multiple systems (CNS, ANS, CVS, etc.).
4	To develop the ability to formulate a research hypothesis and design scientifically valid preclinical experiments.
5	To apply biostatistical tools for analyzing and interpreting preclinical data effectively, including graphical presentation and inferential statistics.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Describe the ethical and regulatory guidelines (CPCSEA, OECD) governing the care, use, and handling of laboratory animals in preclinical research.	L1
CO2	Explain the selection, housing, and handling of commonly used laboratory animals and the routes of drug administration, blood collection, and euthanasia.	L2
CO3	Select and justify appropriate animal models and screening methods for evaluating CNS, ANS, CVS, metabolic, and respiratory system–active drugs.	L3
CO4	Design and conduct basic preclinical experiments, including dose calculation, grouping, and application of research methodology such as hypothesis formulation and literature review.	L3
CO5	Analyze and interpret preclinical experimental data using appropriate	L3

	statistical tools (e.g., t-test, ANOVA) and present the findings in graphical format.	
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Syllabus:

Unit-1	Laboratory Animals and Ethics	Contact Hours: 10
<ul style="list-style-type: none"> • Regulatory guidelines: CPCSEA and OECD standards for animal research. • Laboratory animals: Description, species/strain selection, applications. • Transgenic and mutant animals: Use in research. • Experimental techniques: <ul style="list-style-type: none"> ○ Blood collection: retro-orbital, tail vein, cardiac puncture. ○ Drug administration routes: oral, intraperitoneal, intravenous, etc. ○ Euthanasia techniques (humane and ethical considerations). 		
Unit-2	Preclinical Screening Models – CNS Activity	Contact Hours: 10
<p>Introduction to Screening:</p> <ul style="list-style-type: none"> ○ Dose selection, human-to-animal dose conversion. ○ Drug formulation, animal grouping. ○ Use of sham, negative, and positive controls. ○ Animal species and sex selection. <p>CNS Models:</p> <ul style="list-style-type: none"> ○ Analgesics, antipyretics, anti-inflammatory. ○ General anesthetics, sedatives, hypnotics. ○ Antipsychotics, antidepressants, antiepileptics. ○ Models for Parkinson’s disease, Alzheimer’s, nootropics 		
Unit-3	Preclinical Screening Models – ANS Activity	Contact Hours: 5
<p>Autonomic Nervous System (ANS):</p> <ul style="list-style-type: none"> ○ Sympathomimetics and sympatholytics. ○ Parasympathomimetics and parasympatholytics. ○ Skeletal muscle relaxants. ○ Drugs acting on the eye. ○ Local anesthetics. 		
Unit-4	Preclinical screening models Research methodology and Biostatistics	Contact Hours: 20

Preclinical screening models for CVS activity

- antihypertensives,
- diuretics,
- antiarrhythmic,
- antidyslepidemic,
- anti aggregatory,
- coagulants, and anticoagulants

Preclinical screening models for other important drugs

- antidiabetic
- anticancer
- antiasthmatics.
- Selection of research topic, review of literature.

- Hypothesis formulation and study design.
- Use of t-test, one-way ANOVA.
- Graphical representation and interpretation of data.

Books:

Text Books:

T1: M. N. Ghosh, *Fundamentals of Experimental Pharmacology*, Hilton & Company

T2: S.K. Kulkarni, *Handbook of Experimental Pharmacology*, Vallabh Prakashan

References:

R1: Vogel, H.G., *Drug Discovery and Evaluation: Pharmacological Assays*, Springer

R2: S.K. Gupta, *Drug Screening Methods*, Jaypee Brothers Medical Publishers

R3: P.S.S. Sundar Rao & J. Richard, *An Introduction to Biostatistics: A Manual for Students in Health Sciences*, PHI Learning

R4: CPCSEA Guidelines, *Guidelines for Laboratory Animal Facility*, Issued by: Committee for the Purpose of Control and Supervision of Experiments on Animals (Government of India)

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I	<input checked="" type="checkbox"/>	1hr	7.5		Pharmacy Department	Traditional	Levels 3 to 5
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Assignment	<input checked="" type="checkbox"/>		5		Pharmacy Department	Group	Levels 1 to 5
Class Test	<input checked="" type="checkbox"/>	30mins	5		Pharmacy Department	20 MCQ	Level 1
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	75		Central	Traditional	Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Articulation Matrix

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CO1	3	1	1	1	1	2	3	1	2	1	2	2
CO2	3	2	1	1	1	2	2	1	1	1	2	2
CO3	3	2	2	2	1	2	2	2	1	1	2	3
CO4	3	2	3	2	1	1	2	1	1	1	2	3
CO5	3	2	3	2	1	1	2	1	1	1	2	3

1 = Low, 2 = Moderate, 3 = High contribution.

Program	Bachelor of Pharmacy	Semester VIII			
Course Name	Project Work	L	T	P	C
Course Code	BP813PW	0	0	12	6

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Remarks	Levels
Test I							
Test II							
Assignment							
Class Test							
Comprehensive Exam	<input checked="" type="checkbox"/>	4hr	150		Central	Traditional	Levels 1 to 5

