SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY (PHARMACY)

Syllabus and Structure

of

B. PHARMACY

(2026 Pattern)

(With effect from Academic Year 2026-27 for First Year)

Recommended By

Pharmacy Council of India, New Delhi

in accordance with NEP 2020

Savitribai Phule Pune University, Pune

Ganeshkhind Road, Pune, Maharashtra, 411007, India

GRADUATE ATTRIBUTES (GA's)

Graduate Attributes (GAs) represent the key competencies and professional qualities expected from every pharmacy graduate, irrespective of the program such as D. Pharm, B. Pharm, Pharm. D or M. Pharm. While the level of mastery may vary, these attributes remain common and guide the overall outcomes of pharmacy education.

1. Pharmaceutical Knowledge Proficiency
   – Strong grounding in core and applied pharmaceutical sciences and practice.
2. Scientific and Analytical Thinking
   – Ability to critically analyze data, processes, and clinical information.
3. Ethical and Professional Integrity
   – Commitment to ethical conduct, patient safety, and regulatory compliance.
4. Patient-Centered Orientation
   – Sensitivity to patient needs, cultural diversity, and healthcare outcomes.
5. Industry and Practice Readiness
   – Preparedness for roles in industry, hospitals, community pharmacy, research, and regulation.
6. Digital and Technological Awareness
   – Familiarity with AI, data analytics, automation, and modern pharmaceutical technologies.
7. Effective Communication Skills
   – Clear, empathetic, and professional interaction across healthcare settings.
8. Teamwork and Leadership Skills
   – Ability to collaborate, lead, and contribute constructively in teams.
9. Innovation and Problem-Solving Mindset
   – Capability to identify problems and develop practical, evidence-based solutions.
10. Lifelong Learning Orientation
    – Motivation for continuous professional development and higher education.

PROGRAMME EDUCATIONAL OBJECTIVES

The Bachelor of Pharmacy (B. Pharm) programme aims to prepare graduates with strong knowledge of pharmaceutical sciences, practical skills, professional ethics, and a commitment to patient care and public health. The graduates of the programme are expected to achieve the following Programme Educational Objectives (PEOs):

PEO 1: Apply fundamental knowledge of pharmaceutical sciences to work effectively in pharmacy practice, pharmaceutical industry, research, and related healthcare fields.

PEO 2: Demonstrate practical skills in drug formulation, manufacturing, pharmaceutical analysis, quality control, and pharmacy practice.

PEO 3: Use scientific reasoning and problem-solving skills to address challenges related to medicines, drug development, and patient care.

PEO 4: Practice pharmacy with ethical responsibility, good communication, teamwork, and concern for patient safety and public health.

PEO 5: Pursue continuous learning and professional development to keep pace with advances in pharmaceutical sciences and healthcare.

PROGRAMME OUTCOMES (POs)

Bachelor of Pharmacy (B. Pharm)

PO1. Pharmacy Knowledge Apply comprehensive knowledge of pharmaceutical sciences, biomedical sciences, pharmacology, pharmacognosy, pharmaceutical chemistry, pharmacy practice, and manufacturing processes to understand drug actions, disease mechanisms, and therapeutic interventions and solve professional problems across diverse pharmacy domains.

PO2. Problem Analysis, Critical Thinking and Evidence-Based Decision Making Identify, formulate, analyze, and interpret complex pharmaceutical problems using principles of scientific inquiry, critical thinking, biostatistics, and evidence-based reasoning to arrive at defensible solutions and informed decision-making.

PO3. Pharmaceutical Skills & Practice Demonstrate proficiency in formulation development, analysis, quality assurance, pharmacovigilance, clinical pharmacotherapy, and pharmacy practice through laboratory work, simulations, internships, and experiential learning.

PO4. Modern Tools, AI & Digital Competence Select, apply, and evaluate modern pharmaceutical tools, analytical instruments, digital technologies, artificial intelligence, machine learning, and computational techniques with awareness of their limitations and ethical use.

PO5. Research & Innovation Design and conduct basic research, analyze data, interpret results, and contribute to innovation through research projects, startup initiatives, and problem-based learning relevant to industry, healthcare, and society.

PO6. Professional Ethics & Human Values Apply ethical principles, professional integrity, regulatory frameworks, intellectual property rights, and universal human values while addressing professional, legal, and societal responsibilities in pharmacy practice.

PO7. Communication & Interpersonal Skills Communicate effectively with patients, healthcare professionals, industry personnel, and society through clear documentation, reports, presentations, counseling, teamwork, and interdisciplinary collaboration.

PO8. Leadership, Management & Entrepreneurship Demonstrate leadership, teamwork, planning, and managerial skills in pharmaceutical organizations, healthcare systems, quality systems, and entrepreneurial ventures, including innovation and startup ecosystems.

PO9. Pharmacist & Society Evaluate public health, patient safety, legal, and societal issues related to pharmacy practice and contribute responsibly to healthcare delivery, rational use of medicines, and improvement of community health outcomes.

PO10. Environment and sustainability: Recognize and address the environmental impact of pharmaceutical manufacturing, use, and disposal, and promote environmentally responsible practices, green pharmacy principles, and sustainable healthcare aligned with the United Nation’s Sustainable Development Goals (SDGs).

PO11. Life-Long Learning & Professional Development Recognize the need for continuous learning and demonstrate the ability to engage in self-directed, life-long learning to adapt to technological advancements, evolving healthcare needs, and professional growth.

GLOSSARY

KEYWORD	DEFINITION
Ability Enhancement Courses	Courses of varying durations which are optional, and offered in the curriculum that improves the understanding of the subject and enhance ability of the students.
Academic Calendar	The schedule of the institution for the academic year, giving details of all academic and administrative events.
Assessment	Performance evaluation based on certain established criteria
Attainment of Course Outcomes (COs)	COs are to be attained by all students at the end of a formal course. While the method of computation of attainment of COs is not unique, each institution has to follow a well-defined direct method of computing CO attainment based on the student performance in all assessment instruments, and indirect method of computing Cos through course exit survey of students
Bloom's Taxonomy	A hierarchical framework used to classify educational learning objectives into levels of complexity and specificity, utilized here to design question papers and assessment tools.
Choice Based Credit System (CBCS)	A mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG / PG program. All UG and PG programs, as per UGC, have to implement CBCS
Co-Curricular Activities	Activities, which support the curriculum such as field trips, hospital visits, community medicine shops, display of academic achievements, quiz, debate, discussion, seminars, role-play, etc
Collaboration	Formal agreement/ understanding between any two or more institutions for training, research, student/ faculty exchange or extension support.
Continuous Assessment	A component of internal assessment that evaluates regular engagement, including attendance and student-teacher interaction.
Counseling	Assisting and mentoring students individually or collectively for academic, career, personal and financial decision-making.
Course	A course is a unit of 1 to 6 credits in a formal program. A 3-credit course will have three classroom sessions of one-hour duration during each week for the entire semester.

Course Outcomes (COs)	COs are statements that describe that students should be able to do at the end of a course.
Credit	A credit system is a systematic way of describing an educational programme by attaching credits to its components as a unit of measure for academic work. One (1) credit is assigned for every one hour of lecture per week or every two hours of practical (laboratory) work per week. For internship and projects, 30 hours equals 1 credit.
Cumulative Grade Point Average (CGPA)	A calculation based on the SGPA of all eight semesters, used to determine the final class and rank.
E-learning Resources	Learning resources available on Internet
Elective Courses	A choice available to students to select from among a large number of Courses
Enrichment Courses	Value added courses offered by institution for student empowerment. They enhance the curriculum by amplifying, supplementing and replacing such parts or features as have become ineffective or obsolete.
Evaluation Process	Assessment of learning, teaching and evaluation process and reforms to increase the efficiency and effectiveness of the system.
Experiential Learning	Is a process of learning through experience and is more specifically defined as "learning through reflection on doing".
Field Project	Formal projects students need to undertake that involve conducting surveys outside the college/university premises and collection of data from designated communities or natural places
Graduate Attributes	The disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents for social good in an unknown future.
Grievance Redressal	Mechanisms for receiving, processing and addressing dissatisfaction expressed, complaints and other formal requests made by learners, staff and other stakeholders on the institutional provisions promised and perceived.
ICT	Information and Communication Technology Consists of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images)

	as well as related services.
Internal Examination Committee	A body chaired by the Principal that plans the internal assessment calendar, approves question paper patterns, and addresses student grievances regarding internal marks.
Internship	A mandatory period of at least 240 hours of practical training spread over period of two semesters, work in a pharmaceutical industry, hospital, or clinical research organization, typically completed after Semester IV and VI under an identified mentor.
Learning Outcomes	Specific intentions of a Programme or module, written in clear terms. They describe what a student should know, understand, or be able to do at the end of that Programme or module
Levels of Outcomes	Programme Educational Objectives (PEOs): PEOs are broad statements that describe theprofessional achievements and career accomplishments that graduates are expected to attain a few years after completing the programme. Programme Outcomes (POs): POs are statements that describe the knowledge, skills, and competencies that students should acquire by the time they graduate from the programme. Course Outcomes (COs): COs are statements that describe what students should be able to know, understand, and perform at the end of a specific course.
Miller's Pyramid	A framework for assessing clinical competence, used to monitor the progress and attainment of pharmacy students.
Multi-disciplinary Courses	Courses of varying durations which are optional, and offered outside the curriculum in the multidisciplinary areas that encourage understanding of recent trends in allied areas and helping the students in getting placed.
OBE: Outcome Based Education	OBE is an educational theory that bases each part of an educational system around goals (outcomes). Each student should have achieved the goal by the end of the educational experience

Outcome	An outcome of an educational Programme is what the student should be able to do at the end of a Programme/ course/ instructional unit.
Participative Learning	Participatory Learning and Action is a family of approaches, methods, attitudes, behaviors and relationships, which enable and empower people to share, analyze and enhance their knowledge of their life and conditions, and to plan, act, monitor, evaluate and reflect.
Problem Based Learning (PBL)	Is a student-centred pedagogy in which students learn about a subject through the experience of solving an open-ended problem found in trigger material. The PBL process does not focus on problem solving with a defined solution, but it allows for the development of other desirable skills and attributes. This includes knowledge acquisition, enhanced group collaboration and communication.
Programme	A structured set of courses and learning experiences offered over a specified period, leading to the award of a certificate, diploma, or degree recognized by the appropriate regulatory authority (e.g., UGC/PCI).
Program Committee	A committee led by a senior teacher that reviews class progress, discusses curriculum issues, and monitors the attainment of program outcomes.
Remedial Courses	Courses offered to academically disadvantaged students in order to help them cope with academic requirements.
Research Project	A supervised project carried out in groups of no more than three students during the final year, relating to an elective subject.
Semester	A period of study consisting of not less than 90 working days. Odd semesters run from June/July to November/December, and even semesters run from December/January to May/June
Semester Grade Point Average (SGPA)	A number representing the weighted average of the grade points obtained in all courses during a single semester.
Sessional	Tests conducted for each course during the semester, the average of which contributes to the internal assessment marks.
Skill Enhancement Courses	Courses of varying durations which are optional, and offered in the curriculum that develop the required skills and helping the students in getting placed.
Progression	Vertical movement of students from one level of education to the next higher level successfully or towards gainful employment.

Value Added Courses	Courses of varying durations which are optional, and offered outside the curriculum that add value and helping the students in getting placed.

Chapter 1: Regulations

1. Short title and commencement

This regulation shall be called as "The Regulation for the B. Pharm. Degree Programme Choice Based Credit System (CBCS) as per National Education Policy 2020 of the Pharmacy Council of India, New Delhi". It shall come into effect from Academic year 2026-27. The regulations framed are subject to modification from time to time by Pharmacy Council of India and approved by SPPU.

2. Minimum qualification for admission

2.1 First year B. Pharm:

i. A candidate shall have passed the 10+2 examination conducted by the respective State or Central Government authorities, or any equivalent examination recognized by bodies such as the Association of Indian Universities (AIU) or the Council of Boards of School Education in India (COBSE), including wings such as IGNOU and NIOS, with English as one of the subjects and with Physics and Chemistry as compulsory subjects, along with either Mathematics or Biology or as decided by State Government, Maharashtra.

ii. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

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

Candidate shall have passed in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the Programme

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

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 90 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year. A break of not less than 7 days shall be provided between the semesters.

6. Attendance and progress

A candidate must maintain a minimum of 75% attendance in each individual course. Attendance for theory and practical components shall be considered separately. Only candidates who satisfactorily complete the prescribed course requirements shall be eligible to appear for the respective examinations.

7. Programme/Course credit structure

As per the Choice Based Credit System (CBCS), certain quantum of academic work viz. theory classes, practical classes etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of

the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

7.1. Credit assignment

7.1.1. Theory and Practical courses

Courses are broadly classified as Theory, Practical, Project and Internship. Theory (T) courses consist of lecture (L) hours, while Practical (P) courses consist of hours spent in the laboratory. The Credits (C) assigned to a course dependent on the number of instructional hours per week and are calculated using a multiplier of one (1) for lecture hours, and a multiplier of one-half (1/2) for practical (laboratory) hours. If the calculated credit value results in a fraction of 0.5 or below, the lower integer value will be assigned as the credit. Every 30 hours spent on internship (I) and projects shall be considered equivalent to 1 credit.

7.1.2 Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 193. These credits are distributed across Theory courses, Practical courses, Internship and Project over the duration of eight semesters. The semester-wise distribution of credits is presented in Table IX. Courses generally progress in sequences, building competencies and their positioning indicate certain levels of academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall take additional courses, namely Healthcare Psychology and Communication Skills (Theory and Practical) and Basics of Python Programming for Pharmaceutical Sciences (Theory) during Semester III, and Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory) during Semester IV of the programme. The lateral entry student shall be awarded 47 credit points, equivalent to the cumulative credits earned as per the scheme of their Diploma in Pharmacy (D. Pharm.) programme, upon successful completion of the above-mentioned courses. Out of the total 47 credits, 41 credits shall be accounted for the Diploma programme, and the remaining 6 credits shall be awarded for the above-mentioned additional courses. The 41 credits accounted for the lateral entry students shall be recorded in the Semester III marks sheet.

8. Academic work

A regular record of attendance in Theory, Practical, Internship and Research Projects shall be maintained by the teaching staff of respective courses.

9. Course of study

The course of study for B. Pharm shall include Semester wise Theory & Practical as given in Tables – I to VIII. The number of hours allotted to each theory and practical course in any semester shall not be less than that shown in Tables – I to VIII.

Table-I: Course of study for Semester I

Course Code	Name of the course	No. of hours per week (L/P)	Credit points
BP101T	Basics of Python Programming for Pharmaceutical Sciences (Theory)	2	2
BP102T	General Pharmacy (Theory)	3	3
BP103T	Healthcare Psychology and Communication Skills (Theory)	1	1
BP104T	Human Anatomy, Physiology and Pathophysiology I (Theory)	4	4
BP105T	Introduction to Pharmacognosy (Theory)	3	3
BP106T	Pharmaceutical Inorganic and Analytical Chemistry (Theory)	3	3
BP107P	General Pharmacy (Practical)	3	1
BP108P	Healthcare Psychology and Communication Skills (Practical)	2	1
BP109P	Human Anatomy, Physiology and Pathophysiology I (Practical)	3	1
BP110P	Introduction to Pharmacognosy (Practical)	3	1
BP111P	Pharmaceutical Inorganic and Analytical Chemistry (Practical)	3	1
Total		**30**	**21**

Table-II: Course of study for Semester II

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP201T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)		2	2
BP202T	Biochemistry (Theory)		3	3
BP203T	Human Anatomy, Physiology and Pathophysiology II (Theory)		4	4
BP204T	Pharmaceutical Organic Chemistry (Theory)		4	4
BP205T	Pharmacognosy and Phytochemistry (Theory)		4	4
BP206T	Physical Pharmaceutics (Theory)		3	3
BP207P	Biochemistry (Practical)		3	1
BP208P	Human Anatomy, Physiology and Pathophysiology II (Practical)		3	1
BP209P	Pharmaceutical Organic Chemistry (Practical)		3	1
BP210P	Pharmacognosy and Phytochemistry (Practical)		3	1
BP211P	Physical Pharmaceutics (Practical)		3	1
BP212P SEC*	**BP212P SEC1**	Communication Skills	2	1
	BP212P SEC2	Mental Well-Being, Stress & Conflict Management		
	BP212P SEC3	Fundamentals of Computer Operations		
Total			**37**	**26**

Table-III: Course of study for Semester III

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP301T	Introduction to Machine Learning in Pharmaceutical Sciences (Theory)		2	2
BP302T	Environmental Sciences (Theory)		1	1
BP303T	Ethics and Universal Human Values (Theory)		1	1
BP304T	General Pharmacology (Theory)		3	3
BP305T	Heterocyclic Compounds and Stereochemistry (Theory)		3	3
BP306T	Pharmaceutical Dosage Forms I (Theory)		3	3
BP307T	Pharmaceutical Engineering (Theory)		3	3
BP308T	Pharmaceutical Microbiology (Theory)		3	3
BP309P	General Pharmacology (Practical)		4	2
BP310P	Heterocyclic Compounds and Stereochemistry (Practical)		4	2
BP311P	Pharmaceutical Dosage Forms I (Practical)		3	1
BP312P AEC*	BP312P AEC1	Nutraceuticals and Functional Foods	2	1
	BP312P AEC2	Food Analysis		
	BP312P AEC3	Yoga and Life Sciences		
Total			**32**	**25**

Table-IV: Course of study for semester IV

Course Code	Name of the course	No. of hours per week (L/P)	Credit points
BP401T	Herbal Drug Technology (Theory)	3	3
BP402T	Medicinal Chemistry (Theory)	3	3
BP403T	Pharmaceutical Biotechnology (Theory)	3	3
BP404T	Social Pharmacy and Public Health (Theory)	2	2
BP405T	Systemic Pharmacology I (Theory)	3	3
BP406P	Herbal Drug Technology (Practical)	3	1
BP407P	Medicinal Chemistry (Practical)	3	1
BP408P	Pharmaceutical Biotechnology (Practical)	3	1
BP409P	Social Pharmacy and Public Health (Practical)	2	1
BP410P	Systemic Pharmacology I (Practical)	3	1
BP411I	Internship (Mandatory)	8	4
Total		**28**	**23**

Table-V: Course of study for Semester V

Course Code	Name of the course	No. of hours per week (L/P)	Credit points
BP501T	Biomedicinal Chemistry (Theory)	3	3
BP502T	Industrial Pharmacognosy (Theory)	3	3
BP503T	Innovation and Startup Ecosystem (Theory)	2	2
BP504T	Pharmaceutical Dosage Form II (Theory)	2	2
BP505T	Pharmaceutical Quality Assurance (Theory)	3	3
BP506T	Systemic Pharmacology II (Theory)	3	3
BP507P	Biomedicinal Chemistry (Practical)	4	2
BP508P	Industrial Pharmacognosy (Practical)	3	1
BP509P	Pharmaceutical Dosage Form II (Practical)	3	1
BP510P	Systemic Pharmacology II(Practical)	4	2
Total		**30**	**22**

Table-VI: Course of study for Semester VI

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP601T	Advanced Pharmacognosy (Theory)		3	3
BP602T	Biopharmaceutics and Pharmacokinetics (Theory)		3	3
BP603T	Intellectual Property Rights (Theory)		2	2
BP604T	AI applications in Pharmaceutical Sciences (Theory)		2	2
BP605T	Pharmaceutical Analysis (Theory)		3	3
BP606T	Pharmaceutical Jurisprudence (Theory)		3	3
BP607T AEC*	BP607T AEC1	Green Chemistry	1	1
	BP607T AEC2	Materiovigilance and Hemovigilance		
	BP607T AEC3	Scientific Writing		
	BP607T AEC4	Drug Store and Business Management		
	BP607T AEC5	Career Building in Cultivation of Medicinal Plants		
	BP607T AEC6	Active Pharmaceutical Ingredients and Excipient Sciences		
BP608P	Biopharmaceutics and Pharmacokinetics (Practical)		3	1
BP609P	Pharmaceutical Analysis (Practical)		4	2
BP610P SEC*	BP610P SEC1	Computer-Aided Drug Design	2	1
	BP610P SEC2	Analytical Method Development and Validation		
	BP610P SEC3	Principles of Preclinical Studies		
BP611P VAC*	BP611P VAC1	Professional Skills		
	BP611P VAC2	Process Analytical Technology (PAT) and QbD in Formulation Science	2	1
BP612I	Internship (Mandatory)		8	4
Total			**28**	**26**

Table-VII: Course of study for Semester VII

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP701T	Biostatistics Research methodology (Theory)		3	3
BP702T	Cosmetics and Cosmeceuticals (Theory)		2	2
BP703T	AI in Clinical applications (Theory)		2	2
BP704T	Modern Analytical Techniques (Theory)		3	3
BP705T	Pharmacovigilance (Theory)		3	3
BP706T	Pharmacy Practice (Theory)		3	3
BP707T	Regulatory Affairs (Theory)		2	2
BP708T AEC	BP708T AEC1	Current Good Manufacturing Practices (cGMP)	1	1
	BP708T AEC2	Pharmaceutical Automation		
	BP708T AEC3	Modern Techniques in Cellular Biology		
	BP708T AEC4	Medical Devices		
	BP708T AEC5	Transformation of Food Waste into Medicinal Products		
	BP708T AEC6	Biosimilars, Vaccines & Macromolecules		
BP709P	Modern Analytical Techniques (Practical)		3	1
BP710RP	Research Project		-	6
Total			**22**	**26**

Table-VIII: Course of study for semester VIII

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP801T	Ethical Considerations and Translational Applications of AI in Pharmacy (Theory)			
BP802T	Clinical Pharmacotherapeutics (Theory)		2	2
BP803T	Industrial Pharmacy and Facility Design (Theory)		3	3
BP804T	Pharmaceutical Management (Theory)		2	2
BP805T	Sterile Dosage Forms and Novel Drug Delivery System (Theory)		3	3
	BP806T AEC1	Pharmaceutical Packaging		
BP806T AEC*	BP806T AEC2	Supply Chain Management	2	2
	BP806T AEC3	Industrial Safety and Waste Management		
	BP806T AEC4	Traditional Healing Practices of India		
	BP806T AEC5	Futuristic Pharma through AR/VR: Pharma 4.0		
	BP806T AEC6	Herbal Cosmetics for Industry Perspective		
BP807P	Pharmaceutical Marketing Skills (Practical)		2	1
BP808P	Sterile Dosage Forms and Novel Drug Delivery System (Practical)		4	2
BP809P VAC*	BP809P VAC1	Cleaning Validation	2	1
	BP809P VAC2	Basic Training in Aseptic Handling Techniques		
	BP809P VAC3	Impurity Profiling		
BP810RP	**Research Project**		-	6
Total			22	24

Table-IX: Total Credits per Semester

Semester	Total Credits
I	21
II	26
III	25
IV	23
V	22
VI	26
VII	26
VIII	24
Grand Total	**193**

Note: Earning total credits [193] as mentioned above are mandatory for award of the degree. However, Institute/University has the liberty to offer additional courses as per their mandates or may also offer additional credits through various MOOCs upon approval of their respective academic council.

10. Programme Committee and Internal Examination Committee

10.1 Programme Committee

1. The B. Pharm. Programme shall have a Programme Committee constituted by the Head of the Institution/Principal in consultation with all the Heads of the Departments and reconstituted annually.

2. The composition of the Programme Committee shall be as follows:
   - The Principal/HoI shall serve as the Chairperson
   - One senior teacher from any department shall act as the B. Pharm Coordinator
   - One teacher from each department offering B. Pharm courses and
   - Four student representatives of the programme (one from each academic year), nominated by the Head of the Institution.

3. The Programme Committee shall meet at least twice in every semester to perform the following duties.

4. Duties of the Programme Committee (not limited to):
   i. Periodically reviewing the progress of classes and attendance.
   ii. Discussing problems concerning the curriculum, syllabus, and conduct of classes.
   iii. Communicating its recommendations on academic matters to the Head of the Institution, with such communications being duly recorded.
   iv. Periodically reviewing and monitoring the attainment of Programme Outcomes and Course Outcomes along with Bloom's Taxonomy Levels and/or Miller's Pyramid.
   v. Encouraging the use of ICT tools and providing e-learning resources for higher- order learning.
   vi. Ensuring effective implementation of participative, problem-based, experiential learning, and innovative pedagogical approaches for effective outcomes.
   vii. Encourage faculty to engage in FDP for leading AI-enabled activities.

10.2 **Internal Examination Committee**

1. The B. Pharm. Programme shall have an Internal Examination Committee constituted by the Principal / HoI in consultation with all the Heads of the Departments and may be reconstituted as and when necessary.
2. The composition of the Internal Examination Committee shall be as follows:
   - Principal / HoI – Chairperson
   - B. Pharm Programme Coordinator – Member Secretary
   - One senior faculty member from each department involved in B. Pharm teaching Members
   - College Examination Cell In-charge/Officer – Member

3. The Committee shall meet periodically, before each Sessional Examination (Internal Assessment) and before the end-semester examination.

4. Duties of the Internal Examination Committee (not limited to):

i. Plan and approve the internal assessment calendar for all semesters.

ii. Ensure uniformity, transparency, and fairness in continuous assessment, sessional, and practical examinations.

iii. Moderation of sessional question papers and assessment tools in alignment with programme and course outcomes, incorporating Bloom's Taxonomy Levels and/or Miller's Pyramid.

iv. Monitor the conduct and evaluation of theory, practical, internship, and project assessments.

v. Ensure compliance with PCI regulations, university ordinances, and NEP-2020 assessment reforms.

vi. Promote outcome-based, skill-oriented, and innovative assessment methods.

vii. Review, moderate, and finalize internal assessment marks prior to submission to the university.

viii. Address student grievances related to internal assessments in a timely and structured manner.

ix. Maintain proper records, reports, and minutes related to internal examinations and assessments.

x. Recommend remedial measures and academic support as and when required

xi. Committee may recommend if required resessional /improvement examination to evaluate the attainment for which institute may charge fees as per institute policy.

10.3 Scheme for credit based marks distribution for assessment

The general scheme for credit wise marks distribution is as given below. The detailed scheme for internal assessment and end semester examinations is given in Table – X (a-h).

Credits	Maximum Marks	Internal Assessment	External Assessment
4	100	40	60
3	75	30	45
2 or 1	50	20	30

1. End semester examinations

The End Semester Examinations for each theory and practical course through semesters **I to VIII** shall be conducted by the university. (Table-X).

Table-X: Semester I

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP101T	Basics of Python Programming for Pharmaceutical Sciences (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP102T	General Pharmacy (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP103T	Healthcare Psychology and Communication Skills (Theory)	1	10	10	1 Hr	20	30	1.5 Hr	50
BP104T	Human Anatomy, Physiology and Pathophysiology I (Theory)	4	20	20	1 Hr	40	60	3 Hr	100
BP105T	Introduction to Pharmacognosy (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP106T	Pharmaceutical Inorganic and Analytical Chemistry (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP107P	General Pharmacy (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP108P	Healthcare Psychology and Communication Skills (Practical)	1	10	10	3 Hr	20	30	3Hr	50
BP109P	Human Anatomy, Physiology and Pathophysiology I (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP110P	Introduction to Pharmacognosy (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP111P	Pharmaceutical Inorganic and Analytical Chemistry (Practical)	1	10	10	3 Hr	20	30	3 Hr	50

Table-XI: Semester II

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP201T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP202T	Biochemistry (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP203T	Human Anatomy, Physiology and Pathophysiology II (Theory)	4	20	20	1 Hr	40	60	3 Hr	100
BP204T	Pharmaceutical Organic Chemistry (Theory)	4	20	20	1 Hr	40	60	3 Hr	100
BP205T	Pharmacognosy and Phytochemistry (Theory)	4	20	20	1 Hr	40	60	3 Hr	100
BP206T	Physical Pharmaceutics (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP207P	Biochemistry (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP208P	Human Anatomy, Physiology and Pathophysiology II (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP209P	Pharmaceutical Organic Chemistry (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP210P	Pharmacognosy and Phytochemistry (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP211P	Physical Pharmaceutics (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP212P	SEC – Elective 1 (Practical)	1	10	10	3 Hr	20	30	3 Hr	50

Table-XII: Semester III

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP301T	Introduction to Machine Learning in Pharmaceutical Sciences (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP302T	Environmental Science (Theory)	1	10	10	1 Hr	20	30	1.5 Hr	50
BP303T	Ethics and Universal Human Values (Theory)	1	10	10	1 Hr	20	30	1.5 Hr	50
BP304T	General Pharmacology (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP305T	Heterocyclic Compounds and Stereochemistry (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP306T	Pharmaceutical Dosage Forms I (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP307T	Pharmaceutical Engineering (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP308T	Pharmaceutical Microbiology (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP309P	General Pharmacology (Practical)	2	10	10	4 Hr	20	30	4 Hr	50
BP310P	Heterocyclic Compounds and Stereochemistry (Practical)	2	10	10	4 Hr	20	30	4 Hr	50
BP311P	Pharmaceutical Dosage Forms I (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP312P	AEC – Elective 2 (Practical)	1	10	10	3 Hr	20	30	3 Hr	50

Table-XIII: Semester IV

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP401 T	Herbal Drug Technology (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP402 T	Medicinal Chemistry (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP403 T	Pharmaceutical Biotechnology (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP404 T	Social Pharmacy and Public Health (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP405 T	Systemic Pharmacology I (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP406 P	Herbal Drug Technology (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP407 P	Medicinal Chemistry (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP408 P	Pharmaceutical Biotechnology (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP409 P	Social Pharmacy and Public Health (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP410 P	Systemic Pharmacology I (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP411I	Internship (Mandatory)	4	Refer Section 22	–	–	–	100	4 Hr	100

Table-XIV: Semester V

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP501 T	Biomedicinal Chemistry (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP502 T	Industrial Pharmacognosy (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP503 T	Innovation and Startup Ecosystem (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP504 T	Pharmaceutical Dosage Forms II (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP505 T	Pharmaceutical Quality Assurance (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP506 T	Systemic Pharmacology II (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP507 P	Biomedicinal Chemistry (Practical)	2	10	10	4 Hr	20	30	4 Hr	50
BP508 P	Industrial Pharmacognosy (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP509 P	Pharmaceutical Dosage Forms II (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP510 P	Systemic Pharmacology II (Practical)	2	10	10	4 Hr	20	30	4 Hr	50

Table-XV: Semester VI

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP601T	Advanced Pharmacognosy (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP602T	Biopharmaceutics and Pharmacokinetics (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP603T	Intellectual Property Rights (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP604T	AI Applications in Pharmaceutical Sciences (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP605T	Pharmaceutical Analysis (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP606T	Pharmaceutical Jurisprudence (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP607T	AEC – Elective 3 (Theory)	1	10	10	1 Hr	20	30	1.5 Hr	50
BP608P	Biopharmaceutics and Pharmacokinetics (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP609P	Pharmaceutical Analysis (Practical)	2	10	10	4 Hr	20	30	4 Hr	50
BP610P	SEC – Elective 4 (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP611P	VAC – Elective 5 (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP612I	Internship (Mandatory)	4	Refer Section 22	–	–	–	100	4 Hr	100

Table-XVI: Semester VII

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP701T	Biostatistics and Research Methodology(Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP702T	Cosmetics and Cosmeceuticals (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP703T	AI in Clinical Applications (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP704T	Modern Analytical Techniques (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP705T	Pharmacovigilance (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP706T	Pharmacy Practice (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP707T	Regulatory Affairs (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP708T	AEC – Elective 6 (Theory)	1	10	10	1 Hr	20	30	1.5 Hr	50
BP709P	Modern Analytical Techniques (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP710R P	Research Project	6	Refer Sectio n 21	–	–	-	150	4 Hr	150

Table-XVII: Semester VIII

Course Code	Name of the Course	Credit	Continuous Mode (Marks)	Sessional Exam (Marks)	Sessional Duration	Internal Total	End Semester Marks	End Sem Exam Duration	Total Marks
BP801T	Ethical Considerations and Translational Applications of AI in Pharmacy (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP802T	Clinical Pharmacotherapeutics (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP803T	Industrial Pharmacy and Facility Design (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP804T	Pharmaceutical Management (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP805T	Sterile Dosage Forms and Novel Drug Delivery System (Theory)	3	15	15	1 Hr	30	45	2 Hr	75
BP806T	AEC – Elective 7 (Theory)	2	10	10	1 Hr	20	30	1.5 Hr	50
BP807P	Pharmaceutical Marketing Skills (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP808P	Sterile Dosage Forms and Novel Drug Delivery System (Practical)	2	10	10	4 Hr	20	30	4 Hr	50
BP809P	VAC – Elective 8 (Practical)	1	10	10	3 Hr	20	30	3 Hr	50
BP810R P	Research Project	6	Refer Sectio n 21	–	–	–	150	4 Hr	150

11. 2. Internal assessment: Continuous internal assessment and sessional examination. The marks allocated for Continuous mode of Internal assessment and Sessional examination shall be awarded as per the scheme given below.

Table–XVIII: Scheme for awarding internal assessment: Continuous mode and Sessional

a. Theory:

Theory–Internal Assessment Pattern of Marks Distribution

Theory		**Internal assessment pattern of marks distribution**			
Credit Type	**Max. Marks**	**Total**	**Attendance** (Refer Table–XII) and Student–Teacher Interaction	**Academic Activities** (Average of any three: quiz, assignment, open book test, field work, group discussion, seminar, etc.)	**Sessional** (Average of two exams) Duration 1 Hour
4	100	40	10	10	20
3	75	30	7.5	7.5	15
2 or 1	50	20	05	05	10

b. Practical **Practical – Internal Assessment Pattern of Marks Distribution**

Theory		**Internal assessment pattern of marks distribution**			
Credit Type	**Max. Marks**	**Total**	**Attendance** (Refer Table–XII) and Student–Teacher Interaction	**Based on Practical Records, Regular viva voce, etc.**	**Sessional** (Average of two tests) Duration – As per allotted hours#)
2 or 1	50	20	05	05	10

For practical courses (core as well as elective), those having four hours per week shall have a four-hour duration for the sessional and end-semester examinations. Practical courses with less than four hours per week shall have a three-hour duration for the sessional and end-semester examinations.

Table–XIX: Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**			**Practical**
	4 Credit	**3 Credit**	**2 or 1 Credit**	
90 – 100	4	3.5	2	2
85 – 89	3	2.5	1.5	1.5
75 – 84	2	1.5	1	1
Less than 75	0	0	0	0

11.2.1. Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s)/University. The scheme of question paper for theory and practical Sessional examinations is given in Table XIII– XIV below.

Table–XX: Internal Assessment Question Paper Pattern (Theory)

Type of questions	4 Credit Course	3 Credit Course	2 or 1 Credit Course
I. Multiple Choice Questions (MCQs) Or Objective Type Questions	4×1 Mark each or 2×2 Marks each (Compulsory)	2×1 Mark each (Compulsory)	2×1 Mark each (Compulsory)
II. Short Answers	2×3 Marks each (2 out of 3)	2×3 Marks each (2 out of 3)	1×3 Marks each (1 out of 2)
III. Long Answers	1×10 Marks each (1 out of 2)	1×7 Marks each (1 out of 2)	1×5 Marks each (1out of 2)
Max. Marks	20	15	10
Duration	1 Hour	1 Hour	1 Hour

Table–XXI: Internal Assessment Question Paper Pattern (Practical)

Type of questions	2 or 1 Credit Course
Synopsis	2
Major Experiment	4
Minor Experiment	2
Viva voce	2
Max. Marks	10
Duration	As per the allotted hours in scheme

The average marks of two Sessional exams shall be computed for internal assessment as per the requirements given in Table – XI.

11.3. End semester Examination

The End semester Theory and practical examination shall be conducted as per the scheme given in Table XV– XVI as per the credits allotted.

Table–XXII: End Semester Question Paper Pattern (Theory)

Type of questions	4 Credit Course	3 Credit Course	2 or 1 Credit Course
Multiple Choice Questions (MCQs) Or Objective Type Questions	20×1 Mark each or 10×2 Marks each (Compulsory)	10×1 Mark each (Compulsory)	10×1 Mark each (Compulsory)
II. Short Answers	5×4 Marks each (5 out of 7)	5×4 Marks each (5 out of 7)	5×2 Marks each (5 out of 7)
III. Long Answers	2×10 Marks each (2 out of 3)	2×7.5 Marks each (2 out of 3)	2×5 Marks each (2 out of 3)
Max. Marks	60	45	30
Duration	3 Hours	2 Hours	1.5 Hours

Table–XXIII: End Semester Question Paper Pattern (Practical)

Type of questions	2 or 1 Credit Course
Synopsis	7.5
Major Experiment	10
Minor Experiment	5
Viva voce	7.5
Max. Marks	30
Duration	As per the allotted hours in scheme #

For practical courses (core as well as elective), those having four hours per week shall have a four-hour duration for the sessional and end-semester examinations. Practical courses with less than four hours per week shall have a three-hour duration for the sessional and end-semester examinations.

11. Project work

All students shall undertake a project under the supervision of a teacher and submit a report, preferably with the involvement of an external mentor from Industry, Hospital, NABL or CDSCO-approved labs, or an Allied/Interdisciplinary field. The project shall be carried out in groups not exceeding three members. The project report must be submitted in triplicate as a typed and bound copy of no less than 25 pages. Internal and external examiners appointed by the University shall evaluate the project during the practical examinations of the respective semester(s), and students shall be evaluated in groups. Additionally, students are permitted the option to pursue a continuous research theme initiated in the seventh semester and extending through the eighth semester. Under this provision, the specific project milestones achieved by the conclusion of the seventh semester shall undergo formal evaluation by the appointed examiners during that semester's final examination.

The projects shall be evaluated as per the criteria given in **Table XVIII** and **Table XIX** below.

Table - XXIV: Evaluation of Dissertation Book

Sl. No.	Evaluation Criteria	Maximum Marks
1	Objectives of the work undertaken	10
2	Methodology adopted	20
3	Results and discussion	20
4	Conclusion and outcome	10
	Total	**60**

Table XXV. Evaluation of Dissertation Presentation

Sl. No.	Evaluation Criteria	Maximum Marks
1	Presentation of work	40
2	Communication skills	20
3	Question and answer skills	30
	Total	**90**

Explanation: The 60 marks assigned to the dissertation book shall be same for all the students in a group. However, the 90 marks assigned for presentation shall be awarded based on the performance of individual students in the given criteria.

Sample Rubrics for evaluation of dissertation book is given below:

Sl. No.	Evaluation Criterion	Marks	Level 4 – Excellent	Level 3 – Good	Level 2 – Satisfactory	Level 1 – Needs Improvement
1	**Objectives of the Work Undertaken**	**10**	Objectives are **clear, specific, measurable, relevant and logically aligned** with the research problem. Clearly demonstrates novelty/significance. **9–10**	Objectives are clear and relevant with good alignment to the research problem. Minor scope/clarity issues. **7–8**	Objectives are stated but are somewhat broad, partially aligned or insufficiently justified. **5–6**	Objectives are unclear, vague, unrealistic or poorly related to the research problem. **0–4**
2	**Methodology Adopted**	**20**	Methodology is **scientifically sound, appropriate, systematic and reproducible**. Experimental design, materials, methods, controls, evaluation parameters and statistical methods are adequately justified. **17–20**	Methodology is appropriate and adequately described. Most experimental procedures and evaluation methods are justified; minor gaps present. **13–16**	Methodology is generally appropriate but lacks adequate detail, justification, controls or statistical consideration. **9–12**	Methodology is inappropriate, poorly described, insufficiently controlled or difficult to reproduce. **0–8**
3	**Results and Discussion**	**20**	Results are **accurately presented, systematically analysed and critically discussed**. Appropriate tables/figures/statistics used. Findings are compared with literature and clearly interpreted. **17–20**	Results are clearly presented and adequately interpreted. Literature comparison and statistical analysis are satisfactory, with minor limitations. **13–16**	Results are presented but interpretation is limited. Discussion is largely descriptive with inadequate literature correlation/ statistical interpretation. **9–12**	Results are poorly presented, inadequately analysed or unsupported. Discussion lacks scientific interpretation and correlation with literature. **0– 8**
4	**Conclusion and Outcome**	**10**	Conclusions are **clear, evidence-based and directly derived from objectives and results**. Research outcome, significance, limitations and future scope are appropriately stated. **9–10**	Conclusions are relevant and supported by findings. Outcome and future scope are adequately discussed. **7–8**	Conclusions are partially supported by results or lack adequate linkage with objectives. **5–6**	Conclusions are vague, unsupported, contradictory to results or fail to address objectives. **0–4**
	TOTAL	**60**				

Sample Rubrics for Evaluation of Dissertation Presentation Maximum Marks: 90

Sl. No.	Evaluation Criterion	Marks	Level 4 – Excellent	Level 3 – Good	Level 2 – Satisfactory	Level 1 – Needs Improvement
1	**Presentation of Work**	**40**	Presentation is **highly organized, scientifically accurate and engaging**. Background, rationale, objectives, methodology, results, discussion and conclusion are presented logically. Slides are clear, concise and appropriately illustrated. Excellent time management. **34–40**	Presentation is well organized and scientifically sound. Major components are covered appropriately. Slides are clear with minor issues in organization/design or time management. **27–33**	Presentation covers the major components but lacks logical flow, clarity or appropriate visual presentation. Some important information is missing/overloaded. **20–26**	Presentation is poorly organized, incomplete or difficult to follow. Slides are unclear, excessive or inaccurate. Poor time management. **0–19**
2	**Communication Skills**	**20**	Demonstrates **excellent clarity, confidence, fluency, appropriate scientific terminology, eye contact, voice modulation and professional body language**. Effectively communicates complex concepts. **17–**	Communicates clearly and confidently with appropriate terminology. Minor hesitation or language/body-language issues. **13–16**	Communication is understandable but has noticeable hesitation, limited confidence, inappropriate terminology or limited audience engagement. **9–12**	Communication is unclear, hesitant or excessively dependent on reading slides. Poor scientific terminology and audience engagement. **0–8**

Sl. No.	Evaluation Criterion	Mark s	Level 4 – Excellent	Level 3 – Good	Level 2 – Satisfactory	Level 1 Needs Improvement
3	**Question**	**30**	Demonstrates **excellent subject knowledge and critical thinking**. Answers accurately,	Answers most questions correctly and confidently.	Answers basic questions satisfactorily but	Unable to answer fundamental questions or justify methodology/results.

	and Answer Skills		confidently and logically; interprets findings and justifies methodology/decisions effectively. Handles challenging questions appropriately. **26–30**	Demonstrates good understanding and provides reasonable justification. **21–25**	has difficulty with interpretation, justification or higher-order questions. **15–20**	Responses are inaccurate, vague or unrelated. **0–14**
	TOTAL	**90**				

13 Internship: Every candidate shall be required to complete a minimum of 240 hours of practical training, spread over a period of two semesters, in a Pharmaceutical/ Cosmetics/ Medical Devices/ Food Industry, or in a Hospital/Community Pharmacy, or any other relevant field as per the prescribed course content. He/she has to submit two internship reports which will be evaluated separately.

Certificate and Report submission: 75 Marks Presentation and Discussion: 25 Marks Total: 100 Marks

Note: 02 Semester to be selected from 4th and 6th semester

240 hours of practical training to be divided into two equal parts (120hours each i.e., 15 days) practical training includes onsite training, training at simulation labs, online appropriate tools (Like medical coding, regulatory affairs,QMS software etc.)

14. Industry/Field Visits and other Co-curricular Activities. **It shall be compulsory for pharmacy Institutions to organize industrial/field visit and other co-curricular activities to promote holistic learning through participative, problem-based, experiential and innovative pedagogical methods. Students shall submit individual reports, which shall be assessed in continuous evaluation mode as part of any core course each year, as decided by the Programme Committee.**

– **Industry/Field Visits**

It shall be compulsory for students to undertake at least one industrial/field visit during each year to facilities involved in the manufacturing of active pharmaceutical ingredients, excipients, pharmaceutical formulations, medical devices, food, cosmetics, government/ NABL approved drug and medical device testing laboratories or NABH accredited hospital. It shall be assured by the institutions that the facilities chosen for a particular year shall not be repeated.

– **Memorandum of Understanding (MoU)**

A formal and legally valid Memorandum of Understanding (MoU) must be executed (minimum 10) between the pharmacy Institution and pharmaceutical Industry/ government/NABL approved drug and medical device testing laboratories/ NABH accredited hospital. Out of those MoUs, 5 must be with the pharmaceutical industries.

– **Co-curricular Activities**

It shall be compulsory for the pharmacy institution to adopt a village or a ward in the panchayath/municipal corporation and engage in community service activities. The community services shall include (but not limited to) prescription survey, awareness of rational drug use, patient counselling services or activities as per the prescribed course content.

Semester I (Credit Distribution)

Course Code	Name of the course	No. of hours per week (L/P)	Credit points
BP101T	Basics of Python Programming for Pharmaceutical Sciences (Theory)	2	2
BP102T	General Pharmacy (Theory)	3	3
BP103T	Healthcare Psychology and Communication Skills (Theory)	1	1
BP104T	Human Anatomy, Physiology and Pathophysiology I (Theory)	4	4
BP105T	Introduction to Pharmacognosy (Theory)	3	3
BP106T	Pharmaceutical Inorganic and Analytical Chemistry (Theory)	3	3
BP107P	General Pharmacy (Practical)	3	1
BP108P	Healthcare Psychology and Communication Skills (Practical)	2	1
BP109P	Human Anatomy, Physiology and Pathophysiology I (Practical)	3	1
BP110P	Introduction to Pharmacognosy (Practical)	3	1
BP111P	Pharmaceutical Inorganic and Analytical Chemistry (Practical)	3	1
Total		**30**	**21**

Note: Practical Outcomes are to be assessed based on time to time updation of Miller Pyramid parameters or blooms taxonomy using rubrics

Course Code	Course Title			Course Type
BP101T	Basics of Python Programming for Pharmaceutical Sciences (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
2	2	--	--	30
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

The objectives of this course are to:

1. Introduce the fundamentals of Python programming for pharmaceutical sciences.
2. Develop basic programming skills using control structures, functions, and data structures.
3. Provide knowledge of data handling techniques for structured dataset management.
4. Familiarize students with data analysis tools such as NumPy and Pandas for healthcare datasets.
5. Enable students to visualize and interpret pharmaceutical data.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the fundamentals of Python programming, including variables, data types, operators, and libraries.
2	Analyze program logic using control structures and functions.
3	Organize, manipulate, and retrieve data using data structures and file handling techniques.
4	Analyze pharmaceutical datasets using Python libraries.
5	Visualize and interpret pharmaceutical data using graphical tools.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Introduction to Python programming • Installing Python and an Integrated Development Environment (IDE) [Jupyter Notebook, PyCharm, VS Code etc.], Advantages of IDEs over text editors. • Python variables and data types (integers, floats, strings, booleans), Type casting and basic operators (arithmetic, comparison, logical), Input and output operations.	6 Hours
	• Basic string operations and manipulation techniques. Introduction to standard libraries and third-party libraries, installing and uninstalling libraries.	
II	Control Structures & Functions • Conditional statements (if, if-else, if-elif-else), nested conditions • Loops (for loop, while loop). • Break and continue statements. • Defining and calling functions, passing arguments and returning values. • Writing modular programs for simple pharmaceutical applications- dosage calculation and BMI calculation.	6 hours

III	Data Structures & File Handling • Lists, tuples, and dictionaries. • Indexing and slicing lists, basic operations on lists and dictionaries, string manipulation techniques. • Introduction to NumPy arrays, basic operations using NumPy (array creation, arithmetic operations). • Reading and writing CSV files. • Understanding structured healthcare datasets. • Importing small pharmaceutical datasets and performing basic data access and manipulation tasks.	**6 hours**
IV	Data Handling with Pandas • Introduction to Pandas library. • Pandas Series and DataFrame structures. • Reading CSV and Excel files-PK study datasets and ADR reports • Inspecting datasets using functions such as head(), tail(), info(), and describe. • Data cleaning techniques and handling missing values. • Filtering and selecting data based on conditions. • Grouping data and performing aggregation functions.	**6 Hours**
V	Data Visualization with Matplotlib • Introduction to Matplotlib. • Creating line plots, histograms, scatter plots, and box plots. • Labeling axes, titles, and legends. • Create plots and visualize pharmaceutical datasets - concentration-time curves for oral and IV administration, ADR reporting rates across drugs, dissolution profiles. • Scientific interpretation of plots.	**6 Hours**

Recommended References *(Preferably Latest Editions)*:

1. Weiss, C.J., 2017. *Scientific Computing for Chemists with Python*. Available at: https://weisscharlesj.github.io/SciCompforChemists/notebooks/introduction/intro. ht ml
2. Perkovic, L., 2015. *Introduction to Computing Using Python: An Application Development Focus*. 2nd ed. Hoboken: Wiley.
3. Sweigart, A., 2025. *Automate the Boring Stuff with Python*. 3rd ed. Available at: https://automatetheboringstuff.com/
4. W3Schools, n.d. *Python Tutorial*. Available at: https://www.w3schools.com/python/.
5. Datasets for Education and Research: Mentors and students can access healthcare datasets from sources such as Kaggle (healthcare records), government agencies (healthdata.gov, WHO, https://www.data.gov.in/), and clinical trial registries (https://ctri.nic.in/, https://clinicaltrials.gov/). *Always use data responsibly*.

Course Code	Course Title			Course Type
BP102T	General Pharmacy (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide knowledge about evolution and development of Pharmacy profession in India and the growth of the Pharmaceutical Industries over the years.
2. Provide understanding of different types of pharmacopoeias and other official books in maintaining the standards of medicines.
3. Provide knowledge about the basic pharmaceutical calculations used in dispensing and compounding.
4. Understand the role of active pharmaceutical ingredients and pharmaceutical excipients in drug formulations
5. Impart basic knowledge about formulation and preparation of Various solid, liquid and semisolid dosage forms

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Describe the history and evolution of the pharmacy profession, including pharmacopeial practices and prescription handling.
2	Perform accurate pharmaceutical calculations required in the formulation and preparation of various types of dosage forms.
3	Explain the properties and functions of active pharmaceutical ingredients (APIs) and excipients and demonstrate the methods of preparation of solid dosage forms.
4	Illustrate the formulation principles of liquid dosage forms by analyzing the role of APIs and excipients involved.
5	Compare and evaluate the formulation of semisolid dosage forms based on the characteristics of APIs, excipients, and preparation methods.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Introduction to the Profession of Pharmacy • History of the Profession of Pharmacy in India: In relation to pharmacy education, pharmaceutical industries and organizations – evolution, development and milestones. • Scope of the Pharmacy Profession: Role and responsibilities of pharmacists in retail/community pharmacy, hospital and clinical pharmacy, and industrial pharmacy including research and development. • Pharmacopoeias: Introduction to IP, BP, USP, BPC, International Pharmacopoeia, other pharmacopoeias and the National Formulary of India; structure and content of the Indian Pharmacopoeia; study of one model IP monograph. • Introduction to Prescription: Structure and format/parts of prescription, handling of prescriptions, Latin terminology related to prescriptions.	**9 hours**
II	Introduction to Pharmaceutical Calculations and Dosage Forms • Metric system of weights and measures; calculations based on alligation, proof spirit, isotonic solutions, dilute solutions (percentage and ratio) and geometric dilution; scientific notation of units and measures. • Posology: Definition and dose calculation based on age, body weight and body surface area. • Introduction to Dosage Forms: Routes of administration and classification of dosage forms. • Introduction to Active Pharmaceutical Ingredients a	**9 hours**
III	Solid Dosage Forms • Powders: Classification, advantages and disadvantages; dusting powders, effervescent powders, efflorescent powders, hygroscopic powders and eutectic mixtures; introduction to excipients and methods of preparation. • Tablets: Definition, types of tablets including moulded tablets and pills with examples; advantages and disadvantages; introduction to excipients and methods of preparation. • Capsules: Definition, types of capsules, advantages and disadvantages, capsule sizes; introduction to excipients and methods of preparation.	**9 hours**

IV	Monophasic and Biphasic Liquids • For internal use – aromatic waters, syrups, elixirs and linctus (definition and preparation). • For external use and body cavities – liniments, lotions, throat paints, applications, gargles, mouthwashes, enemas, eye drops, ear drops, nasal drops and tinctures with examples. • Study of official preparations- Introduction to excipients and methods of preparation. • Suspensions- Definition and types (flocculated and deflocculated), advantages and disadvantages, formulation excipients and general methods of preparation. • Emulsions- Definition and types, emulsifying agents, tests for identification of types of emulsions, formulation excipients and general methods of preparation.	**9 hours**
V	Semisolid Dosage Forms • Definitions, classification, advantages and disadvantages, ointment bases and other excipients used in semisolid dosage forms; general methods of preparation of ointments, pastes, creams and gels. • Suppositories / Pessaries: Definition, types of suppositories, advantages and disadvantages, formulation excipients used in suppositories, properties of ideal suppository bases, types of suppository bases, displacement value and general method of preparation.	9 hours

Recommended References (Preferably Latest Editions):

1. Ansel, H.C., Allen, L.V. and Popovich, N.G., Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins, New Delhi.
2. Carter, S.J., Cooper and Gunn's Dispensing for Pharmaceutical Students. CBS Publishers, New Delhi.
3. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad.
4. Indian Pharmacopoeia Commission, National Formulary of India. Ghaziabad, India.
5. British Pharmacopoeia Commission, British Pharmacopoeia. London.
6. United States Pharmacopeial Convention, United States Pharmacopeia (USP–NF). Rockville, Maryland, USA.
7. Lachman, L., Lieberman, H.A. and Kanig, J.L., The Theory and Practice of Industrial Pharmacy. Lea & Febiger, University of Michigan.
8. Gennaro, A.R., Remington: The Science and Practice of Pharmacy. Lippincott Williams & Wilkins, New Delhi.
9. Rawlins, E.A., Bentley's Textbook of Pharmaceutics. Elsevier Health Sciences, USA.
10. Nieloud, F. and Marti-Mestres, G., Pharmaceutical Emulsions and Suspensions. Marcel Dekker Inc., New York.

Course Code	Course Title			Course Type
BP103T	Healthcare Psychology and Communication Skills (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	1	--	--	15
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the fundamental concepts and branches of psychology relevant to healthcare.
2. Help students understand human behavior, development, and psychological responses to illness.
3. Develop awareness of common psychological disorders and coping mechanisms in healthcare contexts.
4. Equip students with effective health communication skills for clinical and community settings.
5. Promote professional interaction with patients, caregivers, and healthcare teams through ethical and empathetic communication. Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the fundamental concepts of psychology and their relevance in healthcare settings.
2	Describe the stages of human development, personality traits, and behavioral responses associated with illness and recovery.
3	Apply effective communication models and techniques in clinical and interdisciplinary healthcare scenarios.
4	Demonstrate professional communication skills including active listening, empathetic interaction, and accurate clinical documentation.
5	Analyze psychological and behavioral interventions that promote mental health, treatment adherence, and stigma reduction.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Introduction to Psychology in Healthcare Definition, scope, and relevance of psychology in health sciences. Branches of psychology with healthcare relevance: clinical, health, behavioural, and developmental psychology. Sensation, perception, and attention in clinical assessment. Learning and memory: reinforcement in health behaviour change. Emotion and motivation: theories and implications in health contexts.	**3 hours**

II	Developmental and Behavioural Psychology Human developmental stages and healthcare needs. Personality theories and patient interaction styles. Psychological factors affecting illness perception and recovery. Common psychological disorders in healthcare: anxiety, depression, and somatization. Coping strategies, resilience, and stress management techniques.	**3 hours**
III	Foundations of Health Communication Elements and models of communication in healthcare. Types of communication: interpersonal, group, mass, and telehealth communication. Barriers to effective communication in clinical settings. Active listening, questioning techniques, and empathy. Culturally appropriate and inclusive communication.	**3 hours**
IV	Professional Communication in Healthcare Settings Communication with patients, caregivers, and interdisciplinary teams. Delivering difficult news and handling emotionally charged situations. Legal and ethical issues in health communication (confidentiality, consent). Writing patient records, reports, and discharge summaries. Use of technology and digital communication tools in healthcare services.	**3 hours**
V	Health Psychology and Behavioural Interventions Health belief models and illness behaviour. Psychosomatic illnesses and the mind–body connection. Behaviour change theories (e.g., CBT, TTM) in treatment adherence. Psychological first aid and crisis communication. Mental health promotion and stigma reduction through communication.	**3 hours**

Recommended References (Preferably Latest Editions)

1. Feldman, R.S., Understanding Psychology. McGraw-Hill Education, New York.
2. Taylor, S.E., Health Psychology. McGraw-Hill Education, New York.
3. Hargie, O., The Handbook of Communication Skills. Routledge, London.
4. Nevid, J.S., Rathus, S.A. and Greene, B., Psychology and the Challenges of Life: Adjustment and Growth. Wiley, New York.
5. Atkinson, R.L., Atkinson, R.C., Smith, E.E., Bem, D.J. and Nolen-Hoeksema, S., Introduction to Psychology. Wadsworth Publishing, Belmont.
6. Kumar, A., Communication Skills for Health Professionals. Jaypee Brothers Medical Publishers, New Delhi.
7. Park, K., Park's Textbook of Preventive and Social Medicine. Banarsidas Bhanot Publishers, Jabalpur.

Course Code	Course Title			Course Type
BP104T	Human Anatomy, Physiology and Pathophysiology I (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

COURSE OBJECTIVES:

The objectives of this course are to:

1. **Understand the structural organization of the human body from cells to systems.**
2. **Comprehend physiological functions of various body systems and the principles of homeostasis.**
3. **Learn the cellular basis of disease including injury, adaptation, and inflammation.**
4. **Recognize common pathological conditions related to skin, bones, joints, blood, cardiovascular system, and special senses.**
5. **Establish the groundwork for clinical interpretation of symptoms and disease mechanisms relevant to pharmacy and therapeutics.**

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the fundamental concepts of Human Anatomy, Physiology and Pathophysiology.
2	Explain the gross morphology, structure and functions of various organs of the human body.
3	Understand the etiology and pathogenesis of diseases/disorders associated with integumentary system, peripheral nervous system and cardiovascular system
4	Understand the basic mechanism behind inflammation
5	Identify and differentiate the various tissues and organs of different systems of human body.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Introduction to human body Cellular and tissue level of organization. Definition and scope of anatomy, physiology and pathophysiology. Levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminologies. Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, forms of intracellular signalling- a) Contact-dependent, b) Paracrine, c) Synaptic, d) Endocrine Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	12 hours

	Basic principles of cell injury and adaptation Components and types of feedback systems, causes of cellular injury, pathogenesis (cell membrane damage, mitochondrial damage, ribosome damage and nuclear damage), morphology of cell injury – adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia), cell swelling, intra cellular accumulation and cell death. Definitions of commonly used relevant medical terminologies.	
II	Integumentary system and wound healing Structure and functions of skin. Skin disorders: Psoriasis and dermatitis and pathophysiology of Leprosy. Basic principles of wound healing. Skeletal system and joints Divisions of skeletal system, types of bones, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction. Structural and functional classification of joints. Diseases of bones and joints Pathophysiology of rheumatoid arthritis, osteoporosis and gout.	12 hours
III	Body fluids, blood and lymphatic system Body fluids, composition and functions of blood, hemopoiesis, formation of haemoglobin, mechanisms of coagulation, blood grouping, Rh factors and transfusion. Lymphatic organs and tissues, lymphatic vessels, lymph formation, circulation and functions of lymphatic system. Basic mechanism of inflammation and repair Introduction, classification and pathophysiology of inflammation, mediators of inflammation. Haematological diseases Pathophysiology of iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, Thalassemia, hereditary acquired anaemia and haemophilia.	**12 hours**
IV	Peripheral nervous system Classification of peripheral nervous system: structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses Structure and functions of eye, ear, nose and tongue. Pathophysiology of special sense disorders- glaucoma, cataract, myopia, otitis externa, otitis media, vertigo and anosmia	**12 hours**

V	Cardiovascular system 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.	**12 hours**
	Pathophysiology of hypertension, cardiac arrhythmias, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and coronary artery disease).	

Recommended References (Preferably Latest Editions):

1. Sembulingam, K. and Sembulingam, P., Essentials of Medical Physiology. Jaypee Brothers Medical Publishers, New Delhi.
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Elsevier Saunders, Philadelphia, USA.
3. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. Wiley, Palmetto, GA, USA.
4. Kumar, V., Cotran, R.S. and Robbins, S.L., Basic Pathology. W.B. Saunders Company, Philadelphia.

Course Code	**Course Title**			**Course Type**
BP105T	**Introduction to Pharmacognosy (Theory)**			**Core**
Credit	**Hours Per Week (L-T-P)**			**Max. Hours**
	L	**T**	**P**	
3	**3**	**--**	**--**	**45**
Maximum Marks	**SE**			**ESE**
75	**30**			**45**

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the origin, history, and classification of natural drugs.
2. Understand cultivation and conservation methods for medicinal plants.
3. Study quality control and evaluation of crude drugs.
4. Study primary and secondary metabolites with their therapeutic relevance
5. Introduce traditional systems of medicine and phyto-therapeutic agents.

COURSE OUTCOMES (CO)

CO No.	Upon successful completion of this course, the students will be able to:
1	Describe the historical development, classification, and scope of Pharmacognosy.
2	Explain cultivation, processing, and conservation techniques for medicinal plants.
3	Apply quality evaluation methods to crude drugs using organoleptic, microscopic, and chemical parameters.
4	Identify primary and secondary metabolites with their therapeutic relevance.
5	Recognize traditional systems of medicine and commonly used phyto-therapeutic agents.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Fundamentals of Pharmacognosy (a) Definition, history, present status, scope and development of pharmacognosy. (b) Sources of drugs: Plants, animals, microbial, marine, mineral and plant tissue culture. (c) Historical milestones in drug discovery: Morphine, quinine, aspirin, warfarin, penicillin, cephalosporin, taxol and artemisinin. (d) Introduction to different herbal / traditional pharmacopoeias: Indian Pharmacopoeia, British Herbal Pharmacopoeia, United States Pharmacopeia – Herbal Medicines and Dietary Supplements, Ayurvedic Pharmacopoeia of India, Unani	10 hours
	Pharmacopoeia of India and American Herbal Pharmacopoeia. (e) Official and non-official; codified and non-codified drugs. Classification of crude drugs: alphabetical, morphological, taxonomical, chemical, pharmacological and chemotaxonomic classification along with their merits and limitations.	
II	Cultivation, Collection, Processing and Storage of Drugs of Natural Origin Methods of plant cultivation and Good Agricultural and Collection Practices (WHO / GAP / GCP guidelines) for medicinal plants. Factors influencing cultivation, collection and storage of medicinal plants. Plant hormones and their applications in cultivation of medicinal plants. Application of polyploidy, mutation and hybridization concepts with reference to secondary metabolites. Ex-situ and in-situ conservation and strategies for value addition of medicinal plants. Role of eco-pharmacognosy in sustainable conservation of endangered medicinal plants such as kutki and chirata.	8 hours
III	Quality Control of Drugs of Natural Origin (WHO Guidelines) Adulteration of drugs of natural origin. Evaluation of drugs using organoleptic, microscopic (qualitative and quantitative), physical, chemical and biological methods. Physicochemical parameters: extractive values, moisture content, foreign organic matter, ash values, bitterness value, foaming index, haemolytic potential, swelling index, viscosity, optical rotation, refractive index, acid value and saponification value. DNA barcoding.	8 hours

IV	Introduction to Metabolites of Plant Origin Definition and general properties of plant metabolites. Primary and secondary metabolites suchascarbohydrates, proteins, lipids, alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils and resins. Traditional Systems of Medicine Basic principles of treatment of diseases in different systems of medicine including AYUSH and TCM. Types of dosage forms in AYUSH medicines. Role of pharmacognosy in allopathy and traditional systems of medicine such as AYUSH and TCM.	12 hours
V	Phyto-therapeutic Agents Biological source, major constituents and uses of the following classes of drugs: • Adaptogens and Immunomodulators: Ashwagandha, Tulsi, Amla • Hepatoprotectives: Milk thistle, Kutki • Cardiovascular drugs: Garlic, Arjuna • •Antidiabetics: Gymnema, Fenugreek • Anti-inflammatory and analgesics: Turmeric, Boswellia • CNS drugs: Brahmi • Antimicrobial and antivirals: Giloy, Neem, Andrographis • Gastrointestinal drugs: Psyllium • Dermatological agents: Aloe • Drugs used in women's health: Chasteberry, Shatavari • Respiratory drugs: Vasaka	7 hours

Recommended References (Preferably latest editions):

1. Evans, W.C., Trease and Evans Pharmacognosy. 16th ed. London: W.B. Saunders & Co., 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy. 9th ed. Philadelphia: Lea & Febiger, 1988.
3. Wallis, T.E., Textbook of Pharmacognosy. London: J. & A. Churchill Ltd.
4. World Health Organization (2002) WHO traditional medicine strategy 2002–2005. Geneva: World Health Organization.
5. World Health Organization (1998) Quality control methods for medicinal plant materials. Geneva: World Health Organization.
6. World Health Organization (2003) WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. Geneva: World Health Organization.

Course Code	**Course Title**			**Course Type**
BP106T	**Pharmaceutical Inorganic and Analytical Chemistry (Theory)**			**Core**
Credit	**Hours Per Week (L-T-P)**			**Max. Hours**
	L	**T**	**P**	
3	**3**	**--**	**--**	**45**
Maximum Marks	**SE**			**ESE**
75	**30**			**45**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the importance of errors, impurities in pharmaceuticals.

2. Comprehend the principles of buffer systems.
3. Develop skills in performing and interpreting limit tests and titrimetric analysis.
4. Emphasize the importance of inorganic compounds and radiopharmaceuticals in Pharmacy
5. Explain synthesis and analysis of inorganic compounds/products of pharmaceutical importance

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Identify sources and types of errors in pharmaceutical analysis, and impurities products
2	Apply concepts of acid-base chemistry, buffer systems with importance of electrolytes
3	Describe and differentiate various analytical techniques used in pharmaceutical analysis, including titrimetric methods, and their specific applications in quality assessment.
4	Analyze the properties, mechanisms, and therapeutic uses of gastrointestinal agents, radiopharmaceuticals, expectorants, antidotes, and other pharmaceutical compounds, illustrating their roles in therapy and safety considerations.
5	Describe the drugs used in expectorants, emetics, haemintics, poison and antidote and astringents.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Introduction to pharmaceutical analysis Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples. Errors Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures. Impurities Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate.	7 hours
II	Acid-Base Chemistry and Buffer Systems in Pharmacy Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. Isotonicity and its application in IV Fluids and Ophthalmic Solutions. Major extra and intracellular electrolytes. Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance.	8 hours
III	Acid base titrations Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves. Assay of Ammonium hydroxide. Non-aqueous titrations. Types of solvents used, acidimetric and alkalimetric titration using non-aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic substances using non-aqueous titrants, estimation of Sodium benzoate. Precipitation titrations and	14 hours

	gravimetry Principle and steps involved in gravimetric analysis, Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry. Complexometric titrations Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*.	
	Redox titrations, Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate. Gastrointestinal agents Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*.	
IV	Agents promote bowel movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate and magnesium trisilicate. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations. Radiopharmaceuticals. Basics of radioactivity, applications of radioisotopes of Sodium Iodide I-131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety.	10 hours
V	Miscellaneous Compounds, Expectorants: Potassium iodide, Ammonium chloride. Emetics: Copper sulphate, Sodium potassium tartrate. Haematinics: Ferrous sulphate, Ferrous gluconate. Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate.	06 hours

Recommended References (Preferably latest editions):

1. Bentley, R. and Driver, J., Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford: Oxford University Press.
2. Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry. Part I & II. London: The Athlone Press, University of London.
4. Schroff, M.L., Inorganic Pharmaceutical Chemistry. New Delhi: Oxford Book Company.
5. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad, India.

Course Code	Course Title			Course Type
BP107P	General Pharmacy (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiarize students with essential pharmaceutical calculations including dilution, concentration, and allegation methods required for accurate formulation of dosage forms.
2. Impart practical skills in the preparation of official and non-official dosage forms such as solutions, syrups, powders, granules, suppositories, semisolids, gargles, and mouthwashes in accordance with pharmacopeial standards.
3. Develop understanding of formulation principles related to selection of ingredients, dosage form design, stability, and patient acceptability.
4. Train students in the application of pharmacopoeial specifications (IP, BPC, WHO) during compounding, labeling, and evaluation of pharmaceutical preparations.
5. Enhance hands-on competency and professional confidence required for dispensing practice and pharmaceutical compounding in hospital and community pharmacy settings.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Perform accurate pharmaceutical calculations using dilution and allegation principles for the preparation of various dosage forms.
2	Prepare and dispense liquid dosage forms such as solutions, syrups, gargles, and mouthwashes following official pharmacopeial procedures.
3	Formulate solid dosage forms including powders, divided powders, dusting powders, and effervescent granules as per standard guidelines.
4	Prepare semisolid and specialized dosage forms such as ointments, liniments, and suppositories using appropriate bases and techniques.
5	Compile and evaluate a compendium of marketed dosage forms, demonstrating compliance with pharmacopeial standards, labeling requirements, and patient-centric considerations

Detailed Syllabus

List of practical

1. Pharmaceutical Calculations Solutions based on allegation and dilution methods

2. Solutions

a) Strong solution of ammonium acetate – IP

b) Cresol with soap solution – IP

c) Lugol's solution – BPC

3. Syrups

a) Simple Syrup – IP

4. Powders & Granules

a) ORS powder – WHO

b) Effervescent granules – IP

c) Dusting powder – IP

d) Divided powders – IP

5. Suppositories

a) Glycerogelatin suppository – BPC

b) Cocoa butter suppository – IP

c) Zinc Oxide suppository – IP

6. Semisolids

a) Sulphur ointment – IP

b) Non-staining iodine ointment with methyl salicylate – BPC

7. Gargles & Mouthwashes

a) Iodine gargle – BPC

b) Chlorhexidine mouthwash – IP

Note:

a) Preparation of compendia of dosage forms (marketed products), is recommended.

b) Any other practical relevant to the syllabus can be introduced.

c) Minimum 12 experiments must be performed covering all dosage forms.

Recommended References (Preferably latest editions):

1. Carter, S.J., Cooper and Gunn's Dispensing for Pharmaceutical Students. 12th ed. New Delhi: CBS Publishers.
2. Indian Pharmacopoeia Commission, Indian Pharmacopoeia, Vol. I. Ghaziabad: IPC.
3. United States Pharmacopeial Convention, United States Pharmacopeia–National Formulary (USP–NF). Rockville, MD, USA.
4. British Pharmacopoeia Commission, British Pharmacopoeia Codex. London: The Stationery Office.

World Health Organization, Oral Rehydration Salts (ORS) Formulation Guidelines. Geneva: WHO.

Course Code	Course Title			Course Type
BP108P	Healthcare Psychology and Communication Skills (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	2	30
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are:

1. To develop effective communication skills essential for diverse clinical and community health scenarios.
2. To enhance empathetic interaction through role plays, simulations, and reflective practices.
3. To promote collaborative learning and peer feedback in communication-based tasks.
4. To encourage application of psychological principles in real-life healthcare contexts.
5. To build confidence in delivering health education and awareness activities in community settings.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Demonstrate patient-centered communication through role plays and clinical simulations.
2	Analyze healthcare communication challenges using case study discussions.
3	Practice reflective listening, paraphrasing, and team-based communication strategies.
4	Design and deliver effective health education messages for the community.
5	Reflect on personal emotional growth and improvement in communication competencies.

Detailed Syllabus:

List of practical

1. Role Plays and Simulations Counselling a patient with chronic illness Breaking bad news in a clinical setting
   Empathetic listening in crisis response.
2. Case Study Discussions
   Mental health cases in primary care
   Impact of miscommunication in healthcare errors
3. Peer-to-Peer Practice Sessions Reflective listening and paraphrasing
   Effective team communication and decision-making
4. Community Engagement Tasks

Designing IEC materials for public health awareness Conducting mock health education sessions

5. Journaling & Self-Reflection Logs
   Weekly reflection on emotional responses during care simulations Growth in communication skill development over the semester.

Recommended References (Preferably latest editions):

1. Morgan, C.T. and King, R.A., Introduction to Psychology. New York: McGraw-Hill.
2. Taylor, S.E., Health Psychology. New York: McGraw-Hill Education.
3. Hargie, O., Skilled Interpersonal Communication: Research, Theory and Practice. London: Routledge.
4. Balzer-Riley, J., Communication in Nursing and Healthcare. Boston: Pearson.
5. Weinman, J., Petrie, K.J. and Moss-Morris, R., The Psychology of Health and Illness. London: Routledge.

Course Code	Course Title			Course Type
BP109P	Human Anatomy, Physiology and Pathophysiology I (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide fundamental knowledge of the structure and functions of various organ systems of the human body.
2. Understand the mechanisms of homeostasis and their role in maintaining normal physiological functions.
3. Introduce the basic concepts of pathophysiology and the causes of diseases affecting different organ systems.
4. Explain the body's physiological responses to disease-producing agents.
5. Lay the foundation for understanding clinical conditions through the study of functional alterations in organs and systems**.**

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the principles, applications, and experimental use of microscopy techniques, and perform basic laboratory experiments related to the nervous system and special senses.
2	Describe the gross morphology, microscopic structure, and coordinated functioning of major human organs and organ systems, emphasizing their roles in maintaining normal physiology.
3	Estimate and interpret key hematological parameters, and explain the mechanisms of homeostasis along with related physiological and pathological disorders.
4	Discuss the etiology and pathogenesis of selected disease states, linking structural and functional changes to clinical manifestations.

5	Identify and explain common diseases with respect to their signs and symptoms, risk factors, diagnostic methods, preventive measures, treatment strategies, and possible complications.

Detailed Syllabus:

List of practical

(Minimum 12 experiments must be performed)

Practical HAPP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated videos, models and charts.

1. Study of compound microscopes.
2. Microscopic study of epithelial and connective tissue.
3. Microscopic study of muscular and nervous tissue.
4. Identification of axial bones.
5. Identification of appendicular bones.
6. Introduction to hemocytometry.
7. Demonstration of total blood count by cell analyzer.
8. Enumeration and interpretation of white blood cell (WBC) count, differential count.
9. Enumeration and interpretation of total red blood corpuscles (RBC) count.
10. Determination of bleeding time and clotting time.
11. Estimation and interpretation of hemoglobin content.
12. Determination of blood group.
13. Determination and interpretation of erythrocyte sedimentation rate (ESR).
14. Determination of pulse rate, heart rate and blood pressure.
15. Recording and interpretation of ECG.
16. To study the cardiovascular system and integumentary system.
17. Case studies/files of patients with anemia, thalassemia, hemophilia, leprosy, gout, hypertension and ischemic heart disease.

Recommended References (Preferably latest editions):

1. Wilson, K.J.W., Anatomy and Physiology in Health and Illness. New York: Churchill Livingstone.
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Philadelphia: Elsevier.
3. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. New York: Wiley.

Course Code	Course Title			Course Type
BP110P	Introduction to Pharmacognosy (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Identify medicinal plants and crude drugs using morphological and microscopical characters.
2. Analyze powdered drugs and perform quantitative microscopy.
3. Evaluate crude drugs using physicochemical parameters.
4. Introduce standardization and quality control of herbal materials.
5. Collect medicinal plants and prepare voucher specimens.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Identify medicinal plants and crude drugs using morphological and microscopical characters.
2	Analyze powdered drugs microscopically to identify diagnostic cell contents.
3	Perform quantitative microscopy for stomatal and vein parameters.
4	Evaluate quality and purity of crude drugs using physicochemical parameters.
5	Collect medicinal plants and prepare voucher specimens during field visits.

Detailed Syllabus:

List of practices

(Minimum 12 experiments must be performed)

1. Morphological study of medicinal plants (as mentioned in Unit V Theory).
2. Organoleptic evaluation and powder microscopical characters of the following drugs: Tulsi and Ashwagandha.
3. Organoleptic evaluation and powder microscopical characters of the following drugs: Amla and Arjuna.
4. Organoleptic evaluation and powder microscopical characters of the following drugs: Turmeric and Psyllium husk.
5. Organoleptic evaluation and powder microscopical characters of the following drugs: Brahmi and Fenugreek.
6. Determination of moisture content of crude drugs.
7. Determination of swelling index and foaming index of crude drugs.
8. Determination of stomatal number and stomatal index of leaf.
9. Determination of vein islet and vein termination number of leaf.
10. Determination of ash value and extractive values of crude drugs.

11. Determination of foreign organic matter of crude drugs.
12. Determination of dimensions of calcium oxalate crystals and phloem fibers by eyepiece micrometry.
13. Determination of percentage purity of powder drug using lycopodium spore method.
14. Experiential learning-based experiments involving collection, identification of medicinal plant material, preparation of voucher specimens and excursion visits to medicinal plant garden.

Recommended References (Preferably Latest Editions):

1. Evans, W.C., 2009. Trease and Evans Pharmacognosy. 16th ed. London: W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., 1988. Pharmacognosy. 9th ed. Philadelphia: Lea & Febiger.
3. Wallis, T.E., Textbook of Pharmacognosy. London: J. & A. Churchill Ltd.

Course Code	Course Title			Course Type
BP111P	Pharmaceutical Inorganic and Analytical Chemistry (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Gain practical knowledge on various volumetric titration techniques.
2. Learn the principles of volumetric analysis.
3. Study the preparation and assessment of inorganic compounds.
4. Determine the assay of various inorganic compounds in pharmaceutical use.
5. Develop analytical skill for the qualitative and quantitative analysis of various inorganic compounds.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Perform limit tests to detect and identify impurities in pharmaceutical substances.
2	Prepare various pharmaceutical inorganic compounds following standard procedures.
3	Analyze the significance of quality control in pharmaceutical products and raw materials.
4	Demonstrate proficiency in titrimetric analysis using different volumetric techniques.
5	Competence in applying analytical skills to qualitative and quantitative data.

Detailed Syllabus:

List of practical

1. Limit tests (Any 4 Experiments) a. Limit test and modified limit test for Chloride as per Indian Pharmacopoeia b. Limit test and modified limit test for sulphate as per Indian Pharmacopoeia c. Limit test for Iron d. Limit test for Lead e. Limit test for arsenic
2. Preparation of inorganic pharmaceuticals (Any 3 Experiments) a. Preparation of Aluminium hydroxide b. Preparation of potash alum c.
   Preparation of ferrous sulphate
   d. Preparation of Magnesium sulphate from magnesium hydroxide or magnesium
3. carbonate. Test for Purity (Any 2 Experiments) a. Assessment of swelling power of bentonite as per Indian Pharmacopoeia b. Evaluation of acid neutralizing capacity of aluminium hydroxide gel c. Determination of potassium iodate and iodine in potassium Iodide
   Assay of the following inorganic compounds including standardization of titrant (Any 5 Experiments) a. Assay of ammonium chloride by acid base titration, b. Assay of Ferrous sulphate by Cerimetry, c. Assay of Copper sulphate by Iodometry, d. Assay of Calcium gluconate by Complexometry,
   e. Assay of Hydrogen peroxide by Permanganometry, f. Assay of Sodium benzoate by non-aqueous titration, g. Assay of
4. Sodium Chloride by precipitation titration (Modified Volhard's method)

Recommended References (Preferably Latest Editions):

1. Bentley, R. and Driver, J., Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford: Oxford University Press.
2. Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry. Part I & II. London: The Athlone Press, University of London.
4. Kennedy, J.H., Analytical Chemistry: Principles. New York: Saunders College Publishing.
5. Schroff, M.L., Inorganic Pharmaceutical Chemistry. New Delhi: Oxford Book Company.
6. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad, India.

Semester II (Credit Distribution)

Course Code	Name of the course		No. of hours per week (L/P)	Credit points
BP201T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)		2	2
BP202T	Biochemistry (Theory)		3	3
BP203T	Human Anatomy, Physiology and Pathophysiology II (Theory)		4	4
BP204T	Pharmaceutical Organic Chemistry (Theory)		4	4
BP205T	Pharmacognosy and Phytochemistry (Theory)		4	4
BP206T	Physical Pharmaceutics (Theory)		3	3
BP207P	Biochemistry (Practical)		3	1
BP208P	Human Anatomy, Physiology and Pathophysiology II (Practical)		3	1
BP209P	Pharmaceutical Organic Chemistry (Practical)		3	1
BP210P	Pharmacognosy and Phytochemistry (Practical)		3	1
BP211P	Physical Pharmaceutics (Practical)		3	1
BP21 PSEC*	BP212P SEC1	Communication Skills	2	1
	BP212P SEC2	Mental Well-Being, Stress & Conflict Management		
	BP212P SEC3	Fundamentals of Computer Operations		
Total			**37**	**26**

* Only one elective course shall be selected

Course Code	Course Title			Course Type
BP201T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
2	2	--	--	30
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain fundamental statistical concepts relevant to pharmaceutical sciences.
2. Develop the ability to interpret clinical and experimental data scientifically.
3. Apply statistical methods for analysing pharmaceutical and biomedical data.
4. Demonstrate the use of Python-based tools for statistical analysis and data handling.
5. Recognize the role of statistical analysis in evidence-based decision making and machine learning applications in healthcare.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Classify pharmaceutical data using appropriate descriptive statistics.
2	Apply probability concepts and statistical distributions in clinical and pharmaceutical contexts.
3	Perform sampling and hypothesis testing for decision-making in research.
4	Analyze correlation and regression relationships in pharmaceutical datasets.
5	Demonstrate statistical analysis using Python and interpret outputs appropriately.

Detailed Syllabus:

Unit No.	Topics	No of Lectures
I	Descriptive Statistics • Types of data in pharmaceutical sciences (nominal, ordinal, interval, ratio) • Sources of data in pharmacy: clinical trials, pharmacovigilance, quality control, PK studies • Measures of central tendency: mean, median, mode, their calculation and interpretation	6 hours
	• Measures of dispersion (range, variance, standard deviation) and their interpretation using pharmaceutical data • Skewness and understanding distribution shape in biological measurements • Perform descriptive statistical analysis using Python libraries such as NumPy and Pandas, with focus on Interpretation of results	
II	Probability & Statistical Distributions in Healthcare • Basic probability concepts and laws (addition and multiplication rules), conditional probability and its interpretation • Bayes' theorem and its application in clinical decision-making • Concept of random variables (discrete and continuous) • Normal distribution and its importance in biological and pharmaceutical measurements, • Binomial distribution demonstrating applications in clinical trial outcomes • Poisson distribution for modeling rare events such as adverse drug reactions • Graphical visualization of these probability distributions using Python	6 hours
III	Sampling & Statistical Inference • Population versus sample, sampling techniques used in clinical research, Sampling error and bias • Conceptual understanding of the Central Limit Theorem • Confidence intervals and their interpretation • Hypothesis testing framework (null and alternative hypotheses) • Type I and Type II errors, p-value and statistical significance • Demonstration, calculation and interpretation of these parameters using python with pharmaceutical data	6 hours

IV	Basics of Correlation & Regression Conceptual understanding of the following concepts with emphasis on their interpretation- • correlation and Pearson correlation coefficients • Interpretation of positive and negative correlations • Scatter plots and trend visualization using pharmaceutical data such as dose-response relationships • Simple linear regression concept, interpretation of regression coefficients • Introduction to odds ratio and its application in clinical risk analysis	6 hours
	Statistical Analysis Using Python – Case based learning • Demonstration of descriptive statistics, correlation analysis and linear regression using Python libraries-SciPy / Statsmodels / Scikit-learn on pharmaceutical datasets • Interpretation of the output summaries and p-values • Preparation of statistical reports	6 hours

Recommended References (Preferably Latest Editions):

1. Lane, D.M., Introduction to Statistics. Houston: Rice University. Available at: https://onlinestatbook.com/2/index.html
2. Walters, S.J., Campbell, M.J. and Machin, D., Medical Statistics: A Textbook for the Health Sciences. Hoboken, NJ: Wiley-Blackwell.
3. Rowe, P., Essential Statistics for the Pharmaceutical Sciences. London: Pharmaceutical Press.
4. Bolton, S. and Bon, C., Pharmaceutical Statistics: Practical and Clinical Applications. New York: Informa Healthcare.
5. De Muth, J.E., Basic Statistics and Pharmaceutical Statistical Applications. Boca Raton, FL: CRC Press.

Course Code	Course Title			Course Type
BP202T	Biochemistry (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain enzymology and various tests in clinical chemistry
2. Understand the biochemical pathways and clinical relevance of carbohydrate, lipid and protein metabolism.
3. Describe energetics and biological oxidation.
4. Explain amino acid and protein metabolism
5. Describe Nucleic acid metabolism and genetic information.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
CO1	Explain the principles ofenzymology and various tests in clinical chemistry
CO2	Describe the classification, the classification, structure, and functions of major biomolecules such as carbohydrates, lipids, proteins, nucleic acids, enzymes, and vitamins.
CO3	Explain the principles of bioenergetics, biological oxidation, and the overview of metabolic pathways of biomolecules, along with their clinical significance.
CO4	Describe metabolism of lipid and its significance.
CO5	Explain metabolism of proteins & its significance and monitoring of metabolic and organ-specific disorders.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Enzymology a. Introduction, properties, nomenclature, and IUB classification of enzymes and coenzymes. Enzyme kinetics (Michaelis plot, Lineweaver–Burk plot). Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzyme regulation. Therapeutic and diagnostic application of enzymes and isoenzymes. Factors affecting enzyme activity. Digestion, absorption function of dietary Macro and Micronutrients, including Vitamins and Minerals, Biochemical functions of vitamins and associated diseases. b. Clinical Chemistry: Liver function tests (routinely performed tests based on liver function). Renal function tests (routinely performed tests based on kidney function, ELISA test)	10 hours
II	a. Introduction about biomolecules – Introduction of carbol b. Bioenergetics: Concept of free energy; relationship between free energy, enthalpy, and entropy; redox potential; energy-rich compounds (ATP, GTP, etc.) and their biological significance. c. Carbohydrate Metabolism and their role in diabetis mellitus: Overview and significance of major pathways: Glycolysis, Citric Acid Cycle (TCA), Gluconeogenesis, Hexose Monophosphate (HMP) shunt, and Glycogen metabolism; regulation of blood glucose levels; metabolic adaptations during fed state, fasting, and prolonged starvation; metabolic derangements in diabetes mellitus and related disorders. d. Biological Oxidation: Electron Transport Chain (ETC), oxidative phosphorylation, and mechanisms of ATP synthesis; regulation and clinical implications of mitochondrial dysfunction and oxidative stress.	10 hours

III	Lipid metabolism a. Classification, functions, and properties of lipids and lipoproteins (HDL, LDL, VLDL, chylomicrons) b. β-oxidation and de-novo synthesis of fatty acids: Ketone bodies: synthesis, utilization, and clinical significance c. Biological significance of cholesterol, lipid profile, and its clinical significance d. Disorders associated with lipid metabolism: Hyperlipidaemias and hypercholesterolemia, lipid storage diseases, atherosclerosis, fatty liver disease, and obesity	7 hours
IV	Amino acids and protein metabolism a. Classification and Biological Functions: Classification and physiological roles of amino acids. Structure and functions of proteins and plasma proteins b. General Metabolism of Amino Acids: Transamination, oxidative and non-oxidative deamination, decarboxylation. Urea cycle – nitrogen disposal and detoxification. Fate of carbon skeletons of amino acids (glucogenic vs ketogenic). Catabolism of Specific Amino Acids and Related Disorders: Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia) and Inborn errors of branched chain and aromatic amino acids d. Biochemical significance of neurotransmitters and hormones derived from amino acids: 5-HT (serotonin), melatonin, dopamine, noradrenaline, adrenaline e. Catabolism of heme and related disorders (jaundice).	10 hours
V	Nucleic acid metabolism and genetic information transfer a. Nucleotide Metabolism and their related disorders: Biosynthesis of purine and pyrimidine nucleotides. Catabolism of purine nucleotides (uric acid formation). Clinical significance of Hyperuricemia and Gout. b. Genome Structure and Central Dogma: Organization of the mammalian genome. Introduction to DNA replication, Transcription, and Translation. c. Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins) d. DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Overview of clinical disorders associated with faulty DNA repair.	8 hours

Recommended References (Preferably latest editions):

1. Nelson, D.L., Cox, M.M. and Hoskins, A., Lehninger Principles of Biochemistry. New York: W.H. Freeman.
2. Kennelly, P.J., Rodwell, V.W., Bender, D.A., Botham, K.M. and Weil, P.A., Harper's Illustrated Biochemistry. New York: McGraw-Hill Education.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Weil, P.A., Harper's Biochemistry. New York: McGraw-Hill.
4. Voet, D. and Voet, J.G., Biochemistry. New York: John Wiley & Sons.
5. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations. New York: Wiley-Liss.
6. Satyanarayana, U. and Chakrapani, U., Biochemistry. Kolkata: Books and Allied (P) Ltd.
7. Stryer, L., Biochemistry. New York: W.H. Freeman.

Course Code	Course Title			Course Type
BP203T	Human Anatomy, Physiology and Pathophysiology II (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

COURSE OBJECTIVES

The objectives of this course are to:

1. Understand the anatomy and physiology of major body systems.
2. Learn mechanisms of neurological, gastrointestinal, respiratory, renal, endocrine, and reproductive functions.
3. Identify common pathophysiological conditions affecting each organ system.
4. Correlate structural and functional abnormalities with disease symptoms.
5. Equip students with foundational knowledge for interpreting disease processes and planning rational pharmacotherapy.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Describe the structural organization of the nervous, gastrointestinal, respiratory, urinary, endocrine and reproductive systems.
2	Explain the physiological mechanisms that regulate the functions of nervous, endocrine and reproductive systems.
3	Illustrate the etiology and development of common diseases affecting different organsystems including cancer.
4	Analyze the pathophysiological alterations associated with disorders of the nervous,gastrointestinal, respiratory, renal and endocrine systems.
5	Interpret clinical manifestations and case findings related to organ system dysfunctions.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Nervous System a) Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse and neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity). b) Pathophysiology of epilepsy, Parkinson's disease, stroke, migraine,depression, schizophrenia, Alzheimer's disease and meningitis.	14 hours
II	Gastrointestinal System a) Anatomy of GI tract with special reference to anatomy and functions of stomach (acid production in the stomach and its regulation through parasympathetic nervous system; role of pepsin in protein digestion). Anatomy and functions of small intestine and large intestine. Anatomy and functions of salivary glands, pancreas and liver. Movements of GIT, digestion and absorption of nutrients. b) Pathophysiology of inflammatory bowel diseases, peptic ulcer, jaundice, hepatitis, typhoid and alcoholic and non alcoholic fatty liver disease	12 hours
III	a) Respiratory System Anatomy of respiratory system with special reference to anatomy of lungs. Mechanism of respiration and regulation of respiration. Lung volumes and capacities, transport of respiratory gases, artificial respiration and resuscitation methods. b) Pathophysiology of asthma, chronic obstructive pulmonary diseases and tuberculosis. c) 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 Renin Angitensin Aldosterone System in kidney. d) Pathophysiology of acute and chronic renal failure and urinary tract infections.	12 hours

IV	Endocrine System a) Classification of hormones and mechanism of hormone action. Structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland and thymus. b) Pathophysiology of diabetes, hypothyroidism, hyperthyroidism, goitre and polycystic ovary syndrome.	10 hours
V	Reproductive System and Cancer a) 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. b) Pathophysiology of sexually transmitted diseases: AIDS, syphilis and gonorrhea. c) Etiology and pathogenesis of cancer.	12 hours

Recommended References (Preferably latest editions):

1. Wilson, K.J.W., Ross and Wilson Anatomy and Physiology in Health and Illness. Churchill Livingstone, New York.
2. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. Palmetto, GA, U.S.A.
3. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Elsevier.
4. Chatterjee, C.C., Human Physiology (Vol. I & II). Academic Publishers, Kolkata.
5. Mohan, H., Textbook of Pathology. Jaypee Publishers.
6. Porth, C.M., Pathophysiology: Concepts of Altered Health States. Lippincott Williams & Wilkins.
7. Kumar, V., Abbas, A.K., Aster, J.C. and Deyrup, A.T., Robbins and Kumar Basic Pathology. Elsevier.

Course Code	Course Title			Course Type
BP204T	Pharmaceutical Organic Chemistry (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

COURSE OBJECTIVES

The objectives of this course are to:

1. Develop a clear understanding of the chemistry of saturated hydrocarbons.
2. Study the chemistry and reactions of unsaturated hydrocarbons.
3. Understand the chemistry and reaction mechanisms of alkyl halides.
4. Explain the chemistry of aromatic hydrocarbons and their derivatives.
5. Provide an understanding of carbonyl compounds and fundamental organic reaction mechanisms relevant to pharmaceuticals.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Describe the chemical reactions and mechanisms of aliphatic saturated hydrocarbons.
2	Explain the reactions and mechanisms of aliphatic unsaturated hydrocarbons.
3	Understand nucleophilic substitution and elimination reactions of alkyl halides.
4	Explain electrophilic aromatic substitution reactions and the effect of substituents.
5	Apply knowledge of carbonyl compounds and reaction mechanisms in pharmaceutical chemistry.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	AliphaticSaturated Hydrocarbons – Alkanes • Methods of preparation: Wurtz reaction, Kolbe's reaction, Clemmensen reduction, Wolff–Kishner reduction • Chemical reactions of alkanes • Mechanism of free radical substitution (halogenation) • Pharmaceutical applications of alkanes: Liquid paraffin, soft paraffin, hard paraffin Cycloalkanes • Baeyer's strain theory and its limitations • Coulson–Moffitt modification • Sachse–Mohr theory	12 hours
II	Aliphatic Unsaturated Hydrocarbons – - Alkenes • Methods of preparation: ○ Dehydration of alcohols ○ Dehydrohalogenation of alkyl halides ○ Dehalogenation of vicinal dihalides ○ Wittig reaction • Chemical reactions of alkenes • Mechanism of electrophilic addition reactions • Markovnikov's and anti-Markovnikov's rule • Ozonoly sis Conjugated Dienes • Stability of conjugated dienes • Mechanism of Diels–Alder reaction Electrophilic and free radical addition reactions • 1,2- and 1,4-addition reactions	12 hours

III	Alkyl Halides
	• Nucleophilic substitution reactions: SN1 and SN2
	  o Mechanism, kinetics, substrate structure, solvent effect, stereochemistry
	• Elimination reactions: E1 and E2
	  o Mechanism, kinetics, substrate structure, solvent effect, stereochemistry
	• Zaitsev's (Saytzeff's) rule with examples
	• Comparison of substitution vs elimination reactions
		12 hours

IV	: Benzene and Its Derivatives – -
	• IUPAC nomenclature of mono- and di-substituted benzene derivatives
	• Structure of benzene
	• Molecular orbital picture and resonance
	• Aromaticity and Hückel's rule
	• Electrophilic aromatic substitution reactions:
	  o Nitration
	  o Halogenation
	  o Friedel–Crafts alkylation and its limitations
	  o Friedel–Crafts acylation
	  o Sulphonation and desulphonation
	• Effect of substituents on reactivity and orientation
		12 hours

V	Carbonyl Compounds - Aldehydes and Ketones • Preparation and properties of carbonyl compounds • Nucleophilic addition reactions • Aldol condensation and crossed aldol condensation • Cannizzaro and crossed Cannizzaro reactions • Benzoin and Perkin condensation • Oxidation and reduction reactions • Pharmaceutical applications of carbonyl compounds: Chloral, Paraldehyde, Ketoprofen	12 hours

Recommended References (Preferably latest editions):

1. Morrison, R.T., Boyd, R.N. and Bhattacharjee, S.K., Organic Chemistry. Pearson Education India.
2. Finar, I.L., Organic Chemistry, Vol. I. Pearson Books.
3. Bahl, B.S. and Bahl, A., Textbook of Organic Chemistry. S. Chand & Company.
4. Furniss, B.S., Vogel's Textbook of Practical Organic Chemistry.

Course Code	Course Title			Course Type
BP205T	Pharmacognosy and Phytochemistry (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

COURSE OBJECTIVES

The objectives of this course are to:

1. Understand major metabolic pathways and the biogenetic origin of primary and secondary phytoconstituents, including the use of modern tools for pathway studies.
2. Study and interpret the pharmacognostic features of crude drugs containing primary metabolites such as carbohydrates, proteins/enzymes, and lipids.
3. Study and interpret the pharmacognostic features of crude drugs containing secondary metabolites such as alkaloids, glycosides, tannins, resins, volatile oils, flavonoids, phenolics, and terpenoids.
4. Impart knowledge of conventional and modern extraction techniques and enable selection of appropriate extraction methods.
5. Develop competency in isolation, identification, characterization, and quality evaluation of medicinal plants and botanicals.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Describe biosynthetic pathways and genetic tools involved in phytoconstituent production.
2	Classify and explain drugs containing primary and secondary metabolites.
3	Apply traditional and modern extraction and isolation methods.
4	Explain qualitative and quantitative analysis of plant metabolites.
5	Evaluate identity, purity, and quality of herbal raw materials.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Metabolic Pathways and Biogenetic Studies – Brief study of basic metabolic pathways and biosynthesis of secondary metabolites including: • Shikimic acid pathway • Acetate pathway • Amino acid pathways Utilization of radioactive isotopes in biogenetic studies. Introduction to pathway prediction tools and modern genetic tools such as CRISPR/Cas9.	10 hours
II	Primary Metabolites – General classification and identification tests Pharmacognostic study (biological source, distribution, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: Carbohydrates: • Acacia, • Agar • Tragacanth • Honey Proteins and Enzymes: • Gelatin • Casein • Proteolytic enzymes: Papain, Bromelain, Serratiopeptidase, Urokinase, Streptokinase, Pepsin Lipids (Waxes, Fats, Fixed Oils): • Castor oil • Olive oil • Cocoa butter • Wool fat • Beeswax	12 hours
III	Secondary Metabolites – General classification and identification tests Pharmacognostic study (biological source, distribution, cultivation of underlined drugs, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: Alkaloids: • Vinca • Rauwolfia	12 hours

	• Opium Volatile Oils: • Lemongrass • Clove • Cinnamon Fennel Tannins: • Myrobalans • Catechu Pomegranate Resins: Guggul Asafoetida Glycosides: • Senna • Liquorice Digitalis Phenylpropanoids and Flavonoids: • Green Tea • Ginkgo • Flax seed Iridoids, Other Terpenoids and Naphthoquinones: • Gentian • Artemisia	
IV	Extraction Methods for Medicinal Plants – Conventional Methods of Extraction: • Infusion • Decoction • Digestion • Maceration • Percolation • Reflux • Distillation • Soxhlet extraction • Successive solvent extraction Modern Methods of Extraction: • Supercritical fluid extraction • Microwave-assisted extraction • Ultrasonic-assisted extraction • Enzyme-assisted extraction • Pressurized liquid extraction	12 hours
V	Overview of Isolation, Identification and Characterization Techniques–	14 hours

	Separation and Isolation Techniques: • Planar chromatography • Column chromatography • Preparative TLC • Flash chromatography Identification Techniques: • Phytochemical tests • Chromatographic techniques • Spectroscopic techniques Fingerprinting of medicinal plants using TLC/HPTLC. Types and significance of markers (phytochemical reference standards). Screening and analysis of major metabolites: • Alkaloids • Glycosides • Saponins • Tannins • Resins • Flavonoids • Phenolics • Steroids	

Recommended References (Preferably latest editions):

1. Dewick, P.M., Medicinal Natural Products: A Biosynthetic Approach. John Wiley & Sons.
2. Evans, W.C., Trease and Evans' Pharmacognosy. W.B. Saunders & Co., London.
3. Wagner, H., and Bladt, S., Plant Drug Analysis: A Thin Layer Chromatography Atlas. Springer-Verlag.
4. Harborne, J.B., Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman & Hall.

Course Code	Course Title			Course Type
BP206T	Physical Pharmaceutics (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide a comprehensive understanding of the theory and principles of pharmaceutical processes and unit operations involved in drug manufacturing.
2. Impart knowledge of physicochemical phenomena such as solubility, dissolution, interfacial phenomena, rheology, and micromeritics relevant to dosage form design.
3. Develop understanding of colloidal and coarse dispersions, including suspensions and emulsions, and their pharmaceutical applications.

4. Familiarize students with rheological and micromeritic properties of powders and dispersions and their role in formulation development and evaluation.
5. Build a strong foundation for formulation development, process optimization, and quality control of pharmaceutical dosage forms.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain and interpret the fundamental principles governing pharmaceutical manufacturing processes and unit operations.
2	Analyze physicochemical properties of drugs and excipients and correlate them with formulation stability, quality, and performance.
3	Apply concepts of interfacial phenomena, colloids, and dispersions in the design and evaluation of pharmaceutical dosage forms.
4	Evaluate and optimize pharmaceutical processes by controlling variables related to rheology, micromeritics, and dispersion systems.
5	Demonstrate foundational competency required for advanced studies in formulation development, industrial pharmacy, and pharmaceutical research.

Detailed Syllabus:

Unit No.	Topics	No. of Lecture s
I	Solubility distribution phenomenon & buffers Solubility expression, Solute solvent interactions, Solubility of liquid and liquids, Solubility of solids and liquids, Solubility of Gas in Liquids, Raoult's Law. Factors affecting solubility, Measurement of saturation Solubility, Effect of pH on solubility, Partition Coefficient – Measurement and significance, Critical Solution Temperature and Applications. Introduction to buffers, Buffers in pharmaceutical and biological system, pH determination methos (Electrometry and colorimetry). Buffer equation / Factor influencing the pH of buffer solutions, Factor influencing Buffer capacity, General procedure for preparing buffers, Indicators.	9 hours

II	Interfacial phenomenon Liquid interface: Surface and interfacial tension, surface free energy, Measurement of surface and interfacial tension, Spreading coefficient, surface active agent, HLB, detergency, types of monolayers at liquid surface. Adsorption at solid interface, Liquid Interface (contact angle, activated charcoal and Wetting). Adsorption of surface-active agents. Electric properties of interface / Electric double layer, Nernst and zeta potential effect of electrolytes	8 hours
III	Colloidal and Coarse Dispersion Colloidal dispersions: Types of colloidal dispersions (Lyophobic, Lyophilic, Association colloids), Optical properties of colloids, Kinetic properties of colloids, Electrical properties of colloids, Size and shape of colloidal systems, Stability of colloidal system (peptization and protective action), Application of Colloidal System. Coarse Dispersions: Suspensions, stokes law (Theory of sedimentation), Effect of Brownian movement / Sedimentation of flocculated particles, sedimentation parameters. Flocculation and controlled structure flocculation. Theories of emulsification and stabilizaition (DLVO Theory, Monomolecular adsorption, Multimolecular adsorption, Film formation, Solid particle adsorption). Physical instabilities of emulsions (creaming, coalescence and breaking, and phase inversion).	12 hours
IV	Rheological studies: Newtonian systems and non-Newtonian systems. Thixotropy – measurement / Bulges and spurs. Negative thixotropy, Determination of rheological properties (Viscometers / single and multi-point). Viscoelasticity, psycho-rheology. Applications of rheology in pharm	8 hours
V	Micromeritics Particle size and size distribution, Particle Shape and Surface area: Methods for determination and significance. Flow properties of powders: determination, significance and methods of enhancement. Advanced flow properties of powers (Powder flow tester).	8 hours

Recommended References (Preferably latest editions):

1. Sinko, P.J., Martin's Physical Pharmacy and Pharmaceutical Sciences.
2. Allen, L.V. and McPherson, T.B., Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.
3. Adejare, A., Remington: The Science and Practice of Pharmacy.
4. Aulton, M.E. and Taylor, K.M.G., Aulton Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.
5. Lachman, L. and Libbermann, H.A., The Theory and Practice of Industrial Pharmacy.

Mendham, J., Denney, R.C., Barnes, J.D. and Thomas, M.J.K., Vogel's Textbook of

6. Quantitative Chemical Analysis. Myers, D., Surfaces, Interfaces, and Colloids: Principles and

Applications. Ladisch, M.R., Rheology of Fluid and Semisolid Foods. Springer.

Course Code	Course Title			Course Type
BP207P	Biochemistry (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES

The objectives of this course are:

1. To develop skills to identify and differentiate carbohydrates and proteins through classical qualitative biochemical tests.
2. To apply biochemical techniques for analysis of pathological conditions using urine and blood samples.
3. To perform estimations of clinically important biomolecules such as glucose, cholesterol, urea, creatinine, uric acid, and proteins in biological fluids.
4. To demonstrate enzymatic activity and study factors affecting enzyme function, including substrate concentration and temperature.
5. To interpret biochemical results and correlate them with clinical conditions such as diabetes, renal dysfunction, and lipid disorders.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Identify proteins and carbohydrates using qualitative biochemical tests and explain their physiological relevance.
2	Detect normal and abnormal constituents in urine and interpret their diagnostic significance.
3	Estimate and interpret levels of glucose, cholesterol, urea, creatinine, uric acid, and serum proteins, and correlate results with clinical conditions.
4	Demonstrate enzyme–substrate reactions and evaluate the effect of temperature and substrate concentration on enzymatic activity.
5	Analyze, record, and report biochemical results accurately and relate practical findings to theoretical knowledge and clinical application.

Detailed Syllabus:

List of practical

(Minimum 12experiments must be performed)

1. Identification tests for proteins (Albumin and Casein).
2. Qualitative analysis of carbohydrates* (Glucose, Fructose, Lactose, Sucrose, and Starch).
3. Qualitative analysis of urine for normal and abnormal constituents.
4. Estimation of blood glucose.
5. Estimation of total cholesterol and HDL cholesterol.
6. Estimation of urea, creatinine, and uric acid in serum.
7. Estimation of serum total protein and albumin.
8. Study of enzymatic hydrolysis of starch.
9. Study of the effect of temperature on salivary amylase activity.
10. Study of the effect of substrate concentration on salivary amylase activity.
11. Estimation of hemoglobin in blood by Sahli's method / Cyanmethemoglobin method.
12. Estimation of serum bilirubin (total and direct bilirubin).
13. Estimation of glycogen content
14. Estimation of SGOT and SGPT

Recommended References (Preferably latest editions):

1. Plummer, D. T. An Introduction to Practical Biochemistry. McGraw-Hill, New York.
2. Wilson, K., and Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
3. Varley, H., Gowenlock, A. H., Bell, M., and Bell, J. L. Varley's Practical Clinical Biochemistry. Heinemann Medical Books.
4. Burtis, C. A., Ashwood, E. R., and Bruns, D. E. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Elsevier.
5. Rodwell, V. W., Bender, D. A., Botham, K. M., Kennelly, P. J., and Weil, P. A. Harper's Illustrated Biochemistry. McGraw-Hill.
6. Freifelder, D. Essential Molecular Biology: A Practical Approach. Oxford University Press.

Course Code	Course Title			Course Type
BP208P	Human Anatomy, Physiology and Pathophysiology II (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide foundational knowledge of the structure and functions of major organ systems of the human body.
2. Develop understanding of physiological mechanisms responsible for maintenance of homeostasis.
3. Explain the pathophysiology of diseases affecting different organ systems.
4. Explore causes of diseases and the body's responses to pathological conditions.

5. Build a strong base for clinical learning through the study of functional and structural changes in disease states.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the gross morphology, structures, and functions of various organs and organ systems of the human body.
2	Demonstrate basic emergency response procedures such as cardiopulmonary resuscitation (CPR).
3	Describe the etiology and pathogenesis of selected disease states.
4	Identify signs and symptoms, risk factors, diagnostic methods, prevention, treatment strategies, and complications of diseases.
5	Understand coordinated working patterns of different organs of each system and perform experiments related to special senses and nervous system.

Detailed Syllabus:

List of practical

(Minimum of 12 experiments must be performed)

Practical HAPP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated videos, models, and charts.

1. Study of nervous system using specimens and models.
2. Study of respiratory system using models.
3. Study of gastrointestinal system using models.
4. Study of reproductive system using models.
5. Demonstration of general neurological examination.
6. Demonstration of function of olfactory nerve.
7. Examination of different types of taste.
8. Demonstration of visual acuity.
9. Demonstration of reflex activity.
10. Recording of body temperature.
11. Determination of tidal volume and vital capacity.
12. Recording of body mass index (BMI).
13. Study of family planning devices and pregnancy diagnosis tests.
14. Understanding pathophysiology of IBD, peptic ulcer, jaundice, hepatitis, typhoid, asthma, tuberculosis, diabetes, and thyroid disorders through case files / case reports.
15. Hands-on training in cardiopulmonary resuscitation (CPR).

Recommended References (Preferably latest editions):

1. Wilson, K. J. W., and Waugh, A. Anatomy and Physiology in Health and Illness.Churchill Livingstone, New York.
2. Best, C. H., and Taylor, N. B. The Physiological Basis of Medical Practice. Williams & Wilkins, Baltimore.
3. Guyton, A. C., and Hall, J. E. Textbook of Medical Physiology. Elsevier / W.B. Saunders, Philadelphia.
4. Tortora, G. J., and Grabowski, S. R. Principles of Anatomy and Physiology. John Wiley & Sons.
5. Brunton, L., Chabner, B., and Knollmann, B. Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill, New York.

Colledge, N. R., Walker, B. R., and Ralston, S. H. Davidson's Principles and Practice of Medicine. Churchill Livingstone, London.

Course Code	Course Title			Course Type
BP209P	Pharmaceutical Organic Chemistry (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES

The objectives of this course are to:

1. Understand and follow essential laboratory safety protocols for handling chemicals, glassware, and equipment.
2. Identify and analyze organic compounds through their physical properties and functional group reactivity.
3. Apply ball-and-stick molecular models to visualize and interpret the structure of organic compounds.
4. Perform purification techniques such as crystallization to isolate and refine organic substances.
5. Synthesize simple organic compounds and their derivatives using standard laboratory methods.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Recall and outline the preliminary qualitative tests used for identifying water- insoluble and immiscible organic compounds.
2	Understand the synthesis methods for preparing simple organic compounds and their derivatives.
3	Apply crystallization techniques to purify organic compounds effectively.
4	Analyze experimentally to detect elements and functional groups to identify unknown organic compounds.
5	Interpret and analyze organic compounds through systematic qualitative analysis to confirm their chemical nature.

List of practical

(Minimum 12 experiments to be performed)

1. Systematic qualitative analysis of minimum of five water-insoluble or water-immiscible unknown organic compounds from different chemical classes:

a. Preliminary tests: Color, odour, Solubility tests, test for aromaticity, test for saturation/unsaturation etc.

b. Detection of elements such as nitrogen, sulphur and halogens by Lassaigne's test

c. Determination of Functional group tests such as phenols, amides, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons

and nitro compounds.

d. Preparation of the derivatives and confirmation of the unknown organic compound by melting point / boiling point.

2. Building Molecular Models:
   Students will use ball-and-stick models to create structures of molecules and understand their shapes and bonding.
3. Crystallization Method

Students will learn how to purify three organic compounds using the crystallization technique.

Recommended References (Preferably latest editions):

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry. Longman Scientific & Technical, London.
2. Mann, F. G. and Saunders, B. C. Practical Organic Chemistry. Pearson Education.
3. Shriner, R. L., Hermann, C. K. F., Morrill, T. C., Curtin, D. Y. and Fuson, R. C. The Systematic Identification of Organic Compounds. John Wiley & Sons.
4. Vogel, A. I. Elementary Practical Organic Chemistry. Longman Group Ltd.
5. Pavia, D. L., Lampman, G. M., Kriz, G. S. and Engel, R. Introduction to Organic Laboratory Techniques. Cengage Learning.

Course Code	Course Title			Course Type
BP210P	Pharmacognosy and Phytochemistry (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES

The objectives of this course are to:

1. Perform chemical tests for the identification of gums, resins, oils, fats, waxes, and unorganized drugs.
2. Examine crude drugs using transverse section and powder microscopy for correct identification.
3. Apply suitable extraction techniques and study their effect on yield of crude extracts.
4. Isolate and identify important phytoconstituents and volatile oils using standard procedures.
5. Evaluateherbal raw materials collected from field/market sources as per Pharmacopoeial standards.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Identify unorganized crude drugs using specific chemical tests.
2	Analyze organized crude drugs through microscopy and powder analysis.
3	Select and perform appropriate extraction methods for herbal drugs.
4	Isolate and characterize phytoconstituents using laboratory techniques and TLC.
5	Assess and compare the quality and purity of herbal raw materials with official standards.

List of practical

(Minimum 12 experiments must be performed)

1. Chemical tests for identification of Agar, Acacia, Tragacanth, Honey.
2. Chemical tests for identification of Castor oil, Olive oil, Wool fat, Beeswax.
3. Chemical tests for identification of Asafoetida, Catechu, Aloe.
4. Transverse section and powder microscopy of a vinca leaf.
5. Transverse section and powder microscopy of a cinnamon bark.
6. Transverse section and powder microscopy of a fennel fruit.
7. Transverse section and powder microscopy of a clove flower bud.
8. Transverse section and powder microscopy of a Tulsi stem.
9. Transverse section and powder microscopy of a Liquorice roots.
10. Study of effect on different extraction techniques on yield of crude extract (maceration, decoction, soxhlation).
11. Isolation of volatile oil and it's TLC.
12. Isolation of caffeine from tea.
13. Isolation of Hesperidin from lemon peel.
14. Isolation of Glycyrhizin from liquorice roots.
15. Isolation of Pectin from orange peel.
16. Experiential learning based experiment involving evaluation and comparison of field/market collected herbal raw materials with Pharmacopoeial standards.

Recommended References (Preferably latest editions):

1. Trease, G. E. and Evans, W. C. Pharmacognosy. Elsevier.
2. Harborne, J. B. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Springer.
3. Wallis, T. E. Textbook of Pharmacognosy. CBS Publishers & Distributors, New Delhi.
4. Tyler, V. E., Brady, L. R. and Robbers, J. E. Pharmacognosy. Lea & Febiger.

Course Code	Course Title			Course Type
BP211P	Physical Pharmaceutics (Practical)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES

The objectives of this course are to:

1. Introduce basic laboratory techniques for determining physicochemical properties such as surface tension, viscosity, and density in pharmaceutical systems.
2. Develop understanding of interfacial phenomena and surfactant behavior, including micelles, critical micellar concentration (CMC), and HLB in formulation design.
3. Train students in evaluating disperse systems through sedimentation studies and the effect of suspending agents.
4. Provide practical experience in powder characterization, including particle size distribution, density, flow properties, porosity, and the role of glidants.
5. Develop skills in determining solubility, partition coefficient, buffer capacity, and related equilibria relevant to drug formulation.

Course Outcomes (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Demonstrate practical knowledge of principles and procedures involved in measuring surface tension, viscosity, density, and related physical properties using standard laboratory apparatus.
2	Determine and interpret surfactant-related parameters such as CMC and HLB and explain their significance in formulation stability and performance.
3	Conduct experiments and analyze results related to sedimentation volume and evaluate the influence of type and concentration of suspending agents on dispersion stability.
4	Evaluate micromeritic and flow properties of powders by determining particle size distribution, bulk density, tapped density, Hausner ratio, Carr's index, angle of repose, true density, and porosity, and interpret the effect of glidants.
5	Perform and assess experiments on solubility, partition coefficient, critical solution temperature, adsorption studies, and buffer capacity, and apply findings to formulation decisions.

List of practical

(Minimum 12 experiments must be performed)

1. Determination of surface tension of given liquids by drop count method and drop weight method.
2. Determination of critical micellar concentration (CMC) of surfactants.
3. Determination of viscosity of liquids using Ostwald's viscometer and Brookfield viscometer.
4. Determination of HLB value of a surfactant.
5. Calculation of isotonicity by different methods (Sodium Chloride Equivalent Method).
6. Determination of particle size and particle size distribution using sieving method.
7. Determination of particle size and particle size distribution using microscopic method.
8. Determination of densities and derived properties of powders (bulk density, tapped density, Hausner ratio, Carr's compressibility index), true density, and porosity.
9. Determination of angle of repose and influence of glidants on angle of repose.
10. Determination of solubility of a drug at different pH/buffer systems at room temperature.
11. Determination of partition coefficient of a drug in n-octanol and water system.
12. Determination of partition coefficient of a drug in benzene and water system.
13. Determination of critical solution temperature and composition of phenol–water system.
14. Determination of specific surface area of charcoal by adsorption of acetic acid on activated charcoal.
15. Determination of buffer capacity at various stages of titration of a weak acid against a strong base and determination of PKa.

Note: Compare the values of various physicochemical properties with marketed formulations wherever possible.

Recommended References *(Preferably latest editions)*:'

1. Sinko, P. J. *Martin's Physical Pharmacy and Pharmaceutical Sciences.* Lippincott Williams & Wilkins.
2. Aulton, M. E. and Taylor, K. M. G. *Aulton's Pharmaceutics: The Design and Manufacture of Medicines.* Elsevier.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. *The Theory and Practice of Industrial Pharmacy.* CBS Publishers & Distributors.
4. Allen, L. V., Popovich, N. G. and Ansel, H. C. *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.* Lippincott Williams & Wilkins.
5. Cooper, S. J. and Gunn, C. *Cooper and Gunn's Tutorial Pharmacy.* CBS Publishers & Distributors.