School of Health Sciences and Technology

[Bachelor of Pharmacy]

w.e.f. 2023 (As per Pharmacy Council of India)

[Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (B. Pharm) Course Regulations 2014]

UPES Campus
Energy Acres
P.O Bidholi via Prem Nagar, Bidholi
Dehradun – 248007, (Uttarakhand)

Tel: + 91-135-2776053/54
Fax: + 91-135-2776090
URL: www.upes.ac.in

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1.0 Abbreviations

Cat	-	Category
L	-	Lecture
T	-	Tutorial
P	-	Practical
Cr	-	Credits
PC	-	Program Core
TC	-	Total Credits

2.0 Vision and Mission of the University:

Vision of UPES

To be an Institution of Global standing for developing professionally competent talent contributing to nation building

Mission of UPES

- Develop industry-focused professionals with an international outlook.
- Foster effective outcome-based education system to continually improve teaching-learning and research.
- Inculcate integrative thought process among students to instill lifelong learning.
- Create global knowledge eco-system through training, research & development and consultancy.
- Practice and promote high standards of professional ethics and develop harmonious relationship with environment and society.

3.0 Vision and Mission of the School

Vision

Leadership in Health Sciences & Technology for improving Planetary, and Public Health

Mission

- To create thought leaders and change makers.
- To design appropriate, holistic and sustainable programs
- To converge multi-disciplinary efforts to make a difference for people and the planet.

4.0 Programme Educational Objectives (PEOs):

PEO 1: To prepare graduates to practice as competent and ethical pharmacists, utilizing their knowledge and skills to provide pharmaceutical care, optimize medication therapy, and promote patient health and well-being.

PEO 2: To prepare graduates to demonstrate leadership skills and a commitment to lifelong learning and professional development, continuously expanding their knowledge base and skills to adapt to advancements in pharmaceutical sciences, pharmacy practice, and healthcare.

PEO 3: To equip graduates with the skills necessary to critically evaluate scientific literature, conduct research, pursue postgraduate studies, or engage in research and scholarly activities, and contribute to the advancement of pharmaceutical sciences.

PEO 4: To prepare graduates to adhere to the highest standards of professionalism, ethics, and integrity in their practice.

5.0 Programme Outcomes (POs):

PO1. Pharmacy Knowledge: Possesses knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioural, social, and administrative pharmacy sciences and manufacturing practices.

PO2. Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO3. Problem analysis: Utilizes the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyse, evaluate and apply information systematically and shall make defensible decisions.

PO4. Modern tool usage: Learns, selects, and applies appropriate methods and procedures, resources and modern pharmacy-related computing tools with an understanding of the limitations.

PO5. Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team building when planning changes required for fulfilment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.

PO6. Professional Identity: Understands, analyzes and communicates the value of their

professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

PO7. Pharmaceutical Ethics: Honours personal values and apply ethical principles in professional and social contexts. Demonstrates behavior that recognizes cultural and personal variability in values, communication and lifestyles. Uses ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO8. Communication: Communicates effectively with the pharmacy community and with society, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO9. The Pharmacist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO10. Environment and sustainability: Understand the impact of the professional pharmacy solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.

PO11. Life-long learning: Recognizes the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and uses feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

Programme Specific Outcomes (PSOs)

Upon completion of the program, the student shall be able to:

PSO 1: Understand various theoretical and practical aspects of pharmaceutical sciences, including principles of drug action, pharmaceutical analysis, pharmacology, pharmacokinetics, pharmaceutics, drug regulation, and pharmaceutical chemistry.

PSO 2: Acquire knowledge of drug development and evaluation processes, including pre-formulation studies, formulation development, clinical trials, and regulatory affairs, to contribute to the development and evaluation of safe and effective pharmaceutical products.

PSO 3: Demonstrate practical skills related to pharmacy practice, including compounding and dispensing medications, patient counseling, monitoring, and managing drug therapy, and collaborating with other healthcare professionals to optimize patient care.

PSO 4: Apply a strong understanding of ethical principles and legal responsibilities related to pharmacy practice. They should uphold professional standards, including patient confidentiality, informed consent, and adherence to applicable laws and regulations.

Programme Grid

B. Pharm Programme (2023-2027)

SEMESTER I

Cat	Course Code	Course Title	L	T	P	TC
PC	BP101T	Human Anatomy and Physiology I	3	1	0	4
PC	BP102T	Pharmaceutical Analysis I	3	1	0	4
PC	BP103T	Pharmaceutics I	3	1	0	4
PC	BP104T	Pharmaceutical Inorganic Chemistry	3	1	0	4
PC	BP105T	Communication skills	3	1	0	2
PC	BP106RBT/ BP106RMT	Remedial Biology / Remedial Mathematics	2	0	0	2
PC	BP107P	Human Anatomy and Physiology Lab	0	0	4	2
PC	BP108P	Pharmaceutical Analysis I Lab	0	0	4	2
PC	BP109P	Pharmaceutics I Lab	0	0	4	2
PC	BP110P	Pharmaceutical Inorganic Chemistry Lab	0	0	4	2
PC	BP111P	Communication skills Lab	0	0	2	1
PC	BP112RBP	Remedial Biology Lab	0	0	2	1

SEMESTER II

Cat	Course Code	Course Title	L	T	P	TC
PC	BP201T	Human Anatomy and Physiology II	3	1	0	4
PC	BP202T	Pharmaceutical Organic Chemistry I	3	1	0	4
PC	BP203T	Biochemistry	3	1	0	4
PC	BP204T	Pathophysiology	3	1	0	4
PC	BP205T	Computer Applications in Pharmacy	3	0	0	3
PC	BP206T	Environmental sciences	3	0	0	3
PC	BP207P	Human Anatomy and Physiology II Lab	0	0	4	2
PC	BP208P	Pharmaceutical Organic Chemistry I Lab	0	0	4	2
PC	BP209P	Biochemistry Lab	0	0	4	2
PC	BP210P	Computer Applications in Pharmacy Lab	0	0	2	1

SEMESTER III

Cat	Course Code	Course Title	L	T	P	TC
PC	BP301T	Pharmaceutical Organic Chemistry II	3	1	0	4
PC	BP302T	Physical Pharmaceutics I	3	1	0	4
PC	BP303T	Pharmaceutical Microbiology	3	1	0	4
PC	BP304T	Pharmaceutical Engineering	3	1	0	4
PC	BP305P	Pharmaceutical Organic Chemistry II Lab	0	0	4	2
PC	BP306P	Physical Pharmaceutics I Lab	0	0	4	2
PC	BP307P	Pharmaceutical Microbiology Lab	0	0	4	2
PC	BP308P	Pharmaceutical Engineering Lab	0	0	4	2

SEMESTER IV

Cat	Course Code	Course Title	L	T	P	TC
PC	BP401T	Pharmaceutical Organic Chemistry III	3	1	0	4
PC	BP402T	Medicinal Chemistry I	3	1	0	4
PC	BP403T	Physical Pharmaceutics II	3	1	0	4
PC	BP404T	Pharmacology I	3	1	0	4
PC	BP405T	Pharmacognosy and Phytochemistry I	3	1	0	4
PC	BP406P	Medicinal Chemistry I Lab	0	0	4	2
PC	BP407P	Physical Pharmaceutics II Lab	0	0	4	2
PC	BP408P	Pharmacology I Lab	0	0	4	2
PC	BP409P	Pharmacognosy and Phytochemistry I Lab	0	0	4	2

SEMESTER V

Cat	Course Code	Course Title	L	T	P	TC
PC	BP501T	Medicinal Chemistry II	3	1	0	4
PC	BP502T	Industrial Pharmacy I	3	1	0	4
PC	BP503T	Pharmacology II	3	1	0	4
PC	BP504T	Pharmacognosy and Phytochemistry II	3	1	0	4
PC	BP505T	Pharmaceutical Jurisprudence	3	1	0	4
PC	BP506P	Industrial Pharmacy I Lab	0	0	4	2
PC	BP507P	Pharmacology II Lab	0	0	4	2
PC	BP508P	Pharmacognosy and Phytochemistry II Lab	0	0	4	2

SEMESTER VI

Cat	Course Code	Course Title	L	T	P	TC
PC	BP601T	Medicinal Chemistry III	3	1	0	4
PC	BP602T	Pharmacology III	3	1	0	4
PC	BP603T	Herbal Drug Technology	3	1	0	4
PC	BP604T	Biopharmaceutics and Pharmacokinetics	3	1	0	4
PC	BP605T	Pharmaceutical Biotechnology	3	1	0	4
PC	BP606T	Quality Assurance	3	1	0	4
PC	BP607P	Medicinal chemistry III Lab	0	0	4	2
PC	BP608P	Pharmacology III Lab	0	0	4	2
PC	BP609P	Herbal Drug Technology Lab	0	0	4	2

SEMESTER VII

Cat	Course Code	Course Title	L	T	P	TC
PC	BP701T	Instrumental Methods of Analysis	3	1	0	4
PC	BP702T	Industrial Pharmacy II	3	1	0	4
PC	BP703T	Pharmacy Practice	3	1	0	4
PC	BP704T	Novel Drug Delivery System	3	1	0	4
PC	BP705P	Instrumental Methods of Analysis Lab	0	0	4	2
PC	BP706PS	Practice School	0	0	12	6

SEMESTER VIII

Cat	Course Code	Course Title	L	T	P	TC
PC	BP801T	Biostatistics and Research Methodology	3	1	0	4
PC	BP802T	Social and Preventive Pharmacy	3	1	0	4
PC	BP813PW	Project Work	0	0	12	6
Choose Any Two						8
PE	BP803ET	Pharma Marketing Management	3	1	0	4
PE	BP804ET	Pharmaceutical Regulatory Science	3	1	0	4
PE	BP805ET	Pharmacovigilance	3	1	0	4
PE	BP806ET	Quality Control and Standardization of Herbals	3	1	0	4
PE	BP807ET	Computer Aided Drug Design	3	1	0	4
PE	BP808ET	Cell and Molecular Biology	3	1	0	4
PE	BP809ET	Cosmetic Science	3	1	0	4
PE	BP810ET	Experimental Pharmacology	3	1	0	4
PE	BP811ET	Advanced Instrumentation Techniques	3	1	0	4
PE	BP812ET	Dietary Supplements and Nutraceuticals	3	1	0	4

SEMESTER I

BP101T	Human Anatomy and Physiology I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Explain the gross morphology, structure, and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Clarify the gross morphology, structure, and elements of different organs of the human body.

CO2: Depict the different homeostatic instruments and their awkward nature.

CO3: Distinguish the different tissues and organs of various frameworks of human body.

CO4: Play out the different trials identified with unique faculties and sensory system.

CO5: Acknowledge composed working example of various organs of every framework

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	1	2	1	1	1	1	3	1	1	3	1	2	1
CO 2	3	1	3	2	1	1	1	1	3	1	1	3	1	2	1
CO 3	3	1	1	1	1	1	1	1	2	1	1	3	1	2	1
CO 4	3	1	2	2	1	1	1	1	3	1	1	3	1	2	1
CO 5	3	1	3	3	1	1	1	1	2	1	1	3	1	2	1
Average	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**3**	**1**	**1**	**3**	**1**	**2**	**1**

Syllabus

UNIT-I: **10 Hours**

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization: Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

UNIT-II: **10 Hours**

Integumentary System: Structure and functions of skin

Skeletal System: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system, Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

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

UNIT-III: **10 Hours**

Body Fluids And Blood: Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

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

UNIT-IV: **08 Hours**

Peripheral Nervous System: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT-V: **07 Hours**

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

Reference (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A. 31
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi
9. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
10. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP102T	Pharmaceutical Analysis I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the principles of volumetric and electro chemical analysis
- Carryout various volumetric and electrochemical titrations
- Develop analytical skills

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Remember the standards of volumetric substance investigation with relevance & significance of analytical and Pharmaceutical Sciences
CO2: Understand basic concepts and principles of titrations.
CO3: Estimate the quantities of analytes using titrations
CO4: Understand the different applications of titration
CO5: Analyze different volumetric and electro chemical analysis and theoretically understand to develop new methods

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs).

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	2	3	1	1	1	1	2	2	3	3	3	3	3
CO 2	3	1	2	2	1	1	1	1	1	1	2	2	-	2	2
CO 3	3	1	2	2	1	1	1	1	1	1	2	3	2	2	3
CO 4	2	1	2	2	-	1	3	1	2	1	2	3	3	-	3
CO 5	2	1	2	2	1	1	3	-	2	1	2	-	3	2	-
Average	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**

Syllabus

UNIT-I: 10 Hours

Pharmaceutical Analysis: Definition and scope, Different techniques of analysis, Methods of expressing concentration, Primary and secondary standards, Preparation and standardization of various molar and normal solutions-Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate.

Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.

Pharmacopoeia: Sources of impurities in medicinal agents, limit tests.

UNIT-II: 10 Hours

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

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

UNIT-III: 10 Hours

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

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

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Basic Principles,methods and application of diazotisation titration.

UNIT-IV: 08 Hours

Redox Titrations: Concepts of oxidation and reduction, Types of redox titrations (Principles and applications), Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V: Electrochemical Methods of Analysis 07 Hours

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

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

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

Reference

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles 6. Indian Pharmacopoeia.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP103T	Pharmaceutics I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Student should be able to understand of history and scope of the pharmaceutical profession and memorize the different sources of professional information.

CO2: Student will be able to identify a legally acceptable prescription and understand the professional way of handling it

CO3: Student will be able to understand and apply pharmaceutical calculations for calculation involved in pharmaceutical dispensing.

CO4: Students will be able to summarize describe and memories about formulation aspects of dosage forms.

CO5: Student will be able to understand various principles behind formulation and evaluation of different dosage forms.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	1	2	2	1	1	1	1	2	-	2	1	2
CO 2	2	-	3	-	-	1	1	1	1	1	-	2	2	1	-
CO 3	-	1	2	1	2	1	1	1	-	1	2	2	-	1	2
CO 4	2	1	2	1	1	1	1	-	1	1	2	2	2	1	2
CO 5	2	2	2	1	1	1	1	1	1	1	2	2	2	-	2
Average	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT – I: 10 Hours

Historical Background and Development of Profession of Pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage Forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II: 10 Hours

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

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

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

UNIT – III: 08 Hours

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

Biphasic Liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV: 08 Hours

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

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

UNIV – V: **07 Hours**

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

Reference and Text Books

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4

2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP104T	Pharmaceutical Inorganic Chemistry	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals along with Pharmacopoeias.

CO2: Explain important functions of electrolytes in body fluids and buffer systems. Classify the dental products including their description.

CO3: Classify gastro intestinal agents with mechanism of action, properties, uses, marketed formulation used

CO4: Define and elaborate details of various inorganic medicinal agents like expectorants, emetics etc.

CO5: Illustrate importance of radiopharmaceuticals and its importance

Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	2	2	1	1	1	1	2	1	2	2	2	1	2
CO 2	3		2	1	1	1	1	1	1	1	2	2	2	1	2
CO 3	3	1	2		1	1	1	1		1	2	2	2	1	2
CO 4	3	1	2	1	1	1	1	1	2	1	2	2	2	1	2
CO 5	3	1	2	1	1	1	1	1		1	2	2	2	1	2

Average	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT I: 10 Hours

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

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

UNIT II: 10 Hours

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

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

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

UNIT III: Gastrointestinal Agents 10 Hours

Acidifiers: Ammonium chloride and diluted HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNIT IV: MISCELLANEOUS COMPOUNDS 08 Hours

Expectorants: Potassium iodide, Ammonium chloride.

Emetics: Copper sulphate, Sodium potassium tartarate

Haematinics: Ferrous sulphate, Ferrous gluconate

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

Astringents: Zinc Sulphate, Potash Alum

UNIT V: **07 Hours**

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

Reference and Text Books

1. Practical Pharmaceutical Chemistry Vol I & II by A.H. Beckett & J.B. Stenlake published by Stahlone Press of University of London, 4th edition.
2. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
3. A.I. Vogel, Text Book of Quantitative Inorganic analysis 3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks =100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical**
95 – 100	4	2

90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP105T	**Communication Skills**	**L-T-P-C: 3-1-0-4**

COURSE OBJECTIVES

- Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Handle interpersonal relations and communicate effectively. Build a repertoire of functional vocabulary.
CO2: Convert the conceptual understanding of communication into everyday practice
CO3: Describe and adapt basic communication skills-listening, speaking, reading and writing
CO4: Personality development to acquire knowledge in respective academic career
CO5: Bring out creativity and other latent talent.

Co-Relationship Mtrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1		2	1	3	2	1	3	2	1	3	2	2	3	2
CO 2	1		2	1	3	2	1	3	2	1	3	2	2	3	2

CO 3	1		2	1	3	2	1	3		1	3	2	2	3	2
CO 4	1		2	1	3	2	1	3	1	1	3	2	2	3	2
CO 5	1		2	1	3	2	1	3		1	3	2	2	3	2
Average	**1**		**2**	**1**	**3**	**2**	**1**	**3**	**1**	**1**	**3**	**2**	**2**	**3**	**2**

Syllabus

UNIT – I: **07 Hours**

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

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

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

UNIT – II: **07 Hours**

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

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

UNIT – III: **07 Hours**

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

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

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

UNIT – IV: **05 Hours**

INTERVIEW SKILLS: Purpose of an interview, Do's and Don'ts of an interview

GIVING PRESENTATIONS: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V: **04 Hours**

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

Reference

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011.
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013.
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011.
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011.
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009.
12. Bringing out the best in PSOple, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Non-University Exam)
Two Sessional Examination (10) + Continuous Mode (05) = 15 marks
End Semester Examination = 35 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP106RBT	Remedial Biology	L-T-P-C: 2-0-0-2

COURSE OBJECTIVES

- Know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Understand diversity of living organisms and flowering plants
CO2: Know the basic components of anatomy & physiology of plant with special reference to human
CO3: Explain the function and co-ordination and regulation of body systems
CO4: Describe nutritional requirements and various metabolism involve in plants and their significance
CO5: Various respiration process and factors affecting growth and development of plant.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	2	2	2	2	1	1	2
CO 2	2	2	2	1	1	1	1	1	2	2	3	2	1	1	2
CO 3	2	2	2	1	1	1	1	1	-	2	1	2	-	1	2
CO 4	2	2	2	1	1	1	1	1	2	2	2	2	1	1	-
CO 5	2	2	2	1	1	1	1	1	2	2	-	2	1	-	2
Average	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**	**2**

Syllabus

UNIT I: 07 Hours

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

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

UNIT II: 07 Hours

Body Fluids and Circulation: Composition of blood, blood groups, coagulation of blood, Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG

Digestion and Absorption: Human alimentary canal and digestive glands, Role of digestive enzymes, Digestion, absorption and assimilation of digested food

Breathing and Respiration: Human respiratory system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes.

UNIT III: 07 Hours

Excretory Products and Their Elimination: Modes of excretion, Human excretory system- structure and function, Urine formation, Rennin angiotensin system

Neural Control and Coordination: Definition and classification of nervous system, Structure of a neuron, Generation and conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical Coordination and Regulation: Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands

Human Reproduction: Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle

UNIT IV: 05 Hours

Plants and Mineral Nutrition: Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis: Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNIT V: **04 Hours**

Plant Respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant Growth and Development: Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators

Cell - the Unit of Life: Structure and functions of cell and cell organelles.Cell division

Tissues: Definition, types of tissues, location and functions.

Reference

1. Text book of Biology by S. B. Gokhale
2. A text book of Biology by Dr. Thulajappa and Dr. Seetaram.
3. A text book of Biology by B.V. Sreenivasa Naidu
4. A text book of Biology by Naidu and Murthy
5. Botany for Degree students By A.C.Dutta.
6. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
7. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

Mode of Evaluation As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Non-University Exam)
Two Sessional Examination (10) + Continuous Mode (05) = 15 marks
End Semester Examination = 35 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1

80 – 84	1	0.5
Less than 80	0	0

BP106RMT	Remedial Mathematics	L-T-P-C: 2-0-0-2

COURSE OBJECTIVES:

- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- Appreciate the important application of mathematics in Pharmacy

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Solve partial fraction, Logarithm, matrices and Determinant.
CO2: Able to understand and solve Analytical geometry
CO3: Able to understand and solve Calculus, differential equation and Laplace transform.
CO4. Know the theory and their application in Pharmacy.
CO5: Appreciate the important application of mathematics in Pharmacy

Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 4	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
CO 5	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	-	**1**	**1**	**1**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

UNIT – I **06 Hours**

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

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

Function*:* Real Valued function, Classification of real valued functions,

Limits and continuity: Introduction, Limit of a function, Definition of limit of a function (definition) Definition of limi.t of a function .

UNIT –II **06 Hours**

Matrices and Determinant:

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations

UNIT – III **06 Hours**

Calculus

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

UNIT – IV **06 Hours**

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula,

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

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

UNIT-V **06 Hours**

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

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

References (Latest Edition)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

Mode of Evaluation:

B. Pharm Total Marks = 50 (Non-University Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

As per PCI regulations (UG)

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP107P	Human Anatomy and Physiology I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Examine the basics of anatomy, physiology, and the cell.
CO2: Identify the structure and function of human skeletal system and different types of tissue.
CO3: Relate the homeostatic mechanism with blood pressure, pulse rate, heart rate and blood coagulation.
CO4: Examine the type of blood group, hemoglobin and enumerate blood cells.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1		1	1	1	1	1	1	-	1	1	2
CO 2	2	1	1	1	2	1	1	1	1	1	1	-	1	1	2
CO 3	2	1	1	1		1	1	1	1	1	1	-	1	1	2
CO 4	2	1	1	1	2	1	1	1	1	1	1	-	1	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**2**

PRACTICALS

1. Microscopic study of epithelial and connective tissue.
2. Microscopic study of muscular and nervous tissue.
3. Identification of axial bones
4. Identification of appendicular bones.
5. Introduction to hemocytometry.
6. Enumeration of white blood cell (WBC) count.
7. Enumeration of total red blood corpuscles (RBC) count.
8. Determination of bleeding time.

9. Determination of clotting time.
10. Estimation of hemoglobin content.
11. Determination of blood group.
12. Determination of erythrocyte sedimentation rate (ESR).
13. Determination of heart rate and pulse rate.
14. Recording of blood pressure.

References (Latest Editions)

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

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP108P	Pharmaceutical Analysis I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Perform the various volumetric and electrochemical titrations.
CO2: Identify and perform the assay of compound with standardization of titrant.
CO3: Develop the ability to make own analytical procedures based on titrations
CO4: Examine the analytical result of assays of pharmaceutical formulations.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	1	2	1	1	3	1	2	1	2	-	2	1	1
CO 2	2	2	1	2	1	1	3	1	2	1	2	2	2	-	1
CO 3	2	2	-	2	1	-	3	1	2	1	2	2	1	1	-
CO 4	2	2	2	2	2	1	3	1	2	1	-	2	2	2	2
Average	**2**	**2**	**1**	**2**	**1**	**1**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. **Limit Test of:** Chloride, Sulphate, Iron, Arsenic
2. **Preparation and Standardization of:** Sodium hydroxide, Sulphuric acid, Sodium thiosulfate, Potassium, permanganate, Ceric ammonium sulphate
3. **Assay of the Compounds Along with Standardization of Titrant:** Ammonium chloride by acid base titration, Ferrous sulphate by Cerimetry, Copper sulphate by Iodometry, Calcium gluconate by complexometry, Hydrogen peroxide by Permanganometry, Sodium benzoate by non-aqueous titration, Sodium Chloride by precipitation titration

4. **Determination of Normality by Electro-Analytical Methods:** Conductometric titration of strong acid against strong base, Conductometric titration of strong acid and weak acid against strong base, Potentiometric titration of strong acid against strong base.

References: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

Mode of Evaluation:

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

As per PCI regulations (UG)

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP109P	Pharmaceutics I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Distinguish and describe the different dosage forms.
CO2: Explain the pharmaceutical incompatibilities and pharmaceutical calculations.
CO3: Formulate and label the different pharmaceutical preparations.
CO4: Evaluate the different dosage forms.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high).

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	-	2	1	1	-
CO 3	-	1	1	1	1	1	-	1	1	1	2	2	1	1	2
CO 4	2	1	-	-	1	1	1	1	1	1	2	2	-	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**

PRACTICALS

1. **Syrups:** Syrup IP'66, Compound syrup of Ferrous Phosphate BPC'68
2. **Elixirs:** Piperazine citrate elixir, Paracetamol pediatric elixir
3. **Linctus:** Terpin Hydrate Linctus IP'66, Iodine Throat Paint (Mandles Paint)
4. **Solutions:** Strong solution of ammonium acetate, Cresol with soap solution, Lugol's solution
5. **Suspensions:** Calamine lotion, Magnesium Hydroxide mixture, Aluminimum Hydroxide gel
6. **Emulsions:** Turpentine Liniment, Liquid paraffin emulsion

7. **Powders and Granules:** ORS powder (WHO), Effervescent granules, Dusting powder, Divded powders
8. **Suppositories:** Glycero gelatin suppository, Coca butter suppository, Zinc Oxide suppository
9. **Semisolids:** Sulphur ointment, Non staining-iodine ointment with methyl salicylate, Carbopal gel
10. **Gargles and Mouthwashes:** Iodine gargle, Chlorhexidine mouthwash

References (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia Latest Edition.
5. British pharmacopoeia Latest Edition.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks

End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP110P	Pharmaceutics Inorganic Chemistry Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Clarify the different methods to determine the impurities and their sources present in inorganic drugs and pharmaceuticals.

CO2: Examine the medicinal and pharmaceutical importance of inorganic compounds.

CO3: Assess the various parameters for performing test for purity of compounds.

CO4: Formulate and evaluate various inorganic pharmaceuticals.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 2	2	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 3	2	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 4	2	1	1	2	1	1	1	1	1	1	2	2	2	1	1
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. **Limit Tests for Following Ions:** Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron, Limit test for Heavy metals, Limit test for Lead, Limit test for Arsenic

2. **Identification Test:** Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate
3. **Test for Purity:** Swelling power of Bentonite, Neutralizing capacity of aluminum hydroxide gel, Determination of potassium iodate and iodine in potassium Iodide
4. **Preparation of Inorganic Pharmaceuticals:** Boric acid, Potash alum, Ferrous sulphate

References (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical / Non-University Exam
95 – 100	4	2
90 – 94	3	1.5

85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP111P	Communication Skills Lab	L-T-P-C: 0-0-2-1

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Describe interpersonal relations and communicate effectively.
CO2: Apply the concept of communication
CO3: Assess the four basic communication skills – Listening, Speaking, Reading and Writing
CO4: Convert the conceptual understanding of communication into everyday practice.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**

PRACTICALS

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

1. **Basic Communication Covering the following Topics:** Meeting PSOple, Asking Questions, Making Friends, What did you do? Do's and Dont's
2. **Pronunciations Covering the following Topics:** Pronunciation (Consonant Sounds), Pronunciation and Nouns, Pronunciation (Vowel Sounds)
3. **Advanced Learning:** Listening Comprehension / Direct and Indirect Speech, Figures of Speech, Effective Communication, Writing Skills, Effective Writing, Interview Handling Skills, E-Mail etiquette, Presentation Skills.

References (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009

Mode of Evaluation As per PCI regulations (UG)

B. Pharm Total Marks = 25 (Practical Exam)
Two Sessional Practical Examination (5) + Continuous Mode (5) = 10 marks
End Semester Practical Examination = 15 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2

2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP112RBP Remedial Biology Lab L-T-P-C: 0-0-2-1

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Explain biology to non-biology students by using various computer models.
CO2: Describe the process of slide preparation.
CO3: Identify and study the cell, tissues of various parts of the plant
CO4: Demonstrate the skeletal system and analyze homeostatic mechanism by correlation with several parameters like blood pressure, tidal volume.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	1	1	1	1	2	2	1	1
CO 2	2	1	1	2	1	1	1	1	1	1	1	2	2	1	1
CO 3	2	1	1	2	1	1	1	1	1	1	1	2	2	1	1

CO 4	2	1	1	2	1	1	1	1	1	1	1	2	2	1	1
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**

PRACTICALS

Introduction to experiments in biology

1. Study of Microscope
2. Section cutting techniques
3. Mounting and staining
4. Permanent slide preparation
5. Study of cell and its inclusions
6. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
7. Detailed study of frog by using computer models
8. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
9. Identification of bones
10. Determination of blood group
11. Determination of blood pressure
12. Determination of tidal volume

References

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

Mode of Evaluation

B. Pharm Total Marks = 25 (Practical Exam)
Two Sessional Practical Examination (5) + Continuous Mode (5) = 10 marks
End Semester Practical Examination = 15 marks

As per PCI regulations (UG)

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2

2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

Semester II

BP201T	Human Anatomy and Physiology II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1. Explain basic fundamental structural features of neurons, mechanism of neurotransmitters along with process of neuroconduction and neurotransmission.

CO2. Describe clinical significance and mechanism along with and digestion and absorption of nutrients and disorders of GIT.

CO3. Analyse mechanism involve in respiration along with clinical significance and disorder of respiratory organs

CO4. Summarize the essentials of Urinary systems involved in regulation of body function and how all parts of human body contribute to maintenance of homeostasis.

CO5. Describe the role of Endocrine system in regulation and functions of hormones to control overall activity of human body.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO 4
CO 1	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 4	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
CO 5	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	-	**1**	**1**	**1**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

UNIT I: NERVOUS SYSTEM **10 Hours**

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

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

UNIT II: DIGESTIVE SYSTEM **06 Hours**

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

ENERGETICS

Formation and role of ATP, Creatinine Phosphate and BMR.

UNIT III: RESPIRATORY SYSTEM **10 Hours**

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

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

URINARY SYSTEM

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

UNIT IV: ENDOCRINE SYSTEM **10 Hours**

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

UNIT V: REPRODUCTIVE SYSTEM **09 Hours**

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

INTRODUCTION TO GENETICS

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

Reference (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.31
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
9. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

10. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata.

Mode of Evaluation:

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

As per PCI regulations (UG)

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP202T	Pharmaceutical Organic Chemistry I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Understand the structure, name and the type of isomerism of the organic compound
2. Describe the reaction, name the reaction and orientation of reactions
3. Describe the basis of reactivity/stability of compounds,
4. Identify/confirm the organic compound

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Illuminate relevance & significance of organic chemistry to Pharmaceutical Sciences.
CO2: Explain basic functional groups, IUPAC Nomenclature and different isomerisms of Organic Compounds.
CO3: Comprehend & explain how Addition & Elimination Reactions are performed with respect to Alkenes and alkynes
CO4: Describe the synthesis of various organic compounds like aliphatic and aromatic compounds which contain carboxylic groups, aldehydes, and ketones.
CO5: Explain importance of identification test, basicity and pharmaceutical importance of amines.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO 4
CO 1	2	1	1	1	1	1	1	1	1	1	2	3	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	1	2	3	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	1	2	3	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	1	2	3	2	1	1
CO 5	2	1	1	2	1	1	1	1	1	1	2	3	2	1	1
Average	2	1	1	1.2	1	1	1	1	1	1	2	3	2	1	1

Syllabus

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

UNIT-I: CLASSIFICATION, NOMENCLATURE AND ISOMERISM 7 Hours

Classification of Organic, Compounds, Common and IUPAC, systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

UNIT-II: ALKANES*, ALKENES* AND CONJUGATED DIENES* 10 Hours

SP hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP hybridization in alkenes, E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III: ALKYL HALIDES* 10 Hours

SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions, Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

ALCOHOLS Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV: CARBONYL COMPOUNDS (ALDEHYDES AND KETONES) 10 HOURS

Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

UNIT-V: CARBOXYLIC ACIDS **08 Hours**

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

ALIPHATIC AMINES

Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

References (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP203T	Biochemistry	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe the role of biochemical processes in cell metabolism.
CO2. Explain the mechanism and role of carbohydrate metabolic pathways
CO4: Differentiate and discuss the various metabolic processes and energetic of lipids and amino acids Fat and Nucleic acids.
CO4. Identify and explain the genetic organization of mammalian genome and functions of DNA, RNA, proteins, and their synthesis.
CO5. Depict the characteristics, functions and structure of enzymatic activity and its applications

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 2	2	1	-	1	1	1	1	1	1	1	2	2	2	1	1
CO 3	2	1	2	1	1	1	1	1	1	1	2	2	2	1	1
CO 4	2	1	-	1	1	1	1	1	1	1	2	2	2	1	1
CO 5	2	1	2	1	1	1	1	1	1	1	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT I: Biomolecules **08 Hours**

Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

BIOENERGETICS

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

UNIT II: CARBOHYDRATE METABOLISM **10 Hours**

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

BIOLOGICAL OXIDATION

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

UNIT III: LIPID METABOLISM **10 Hours**

β-Oxidation of saturated fatty acid (Palmitic acid), Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid), Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D, Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

AMINO ACID METABOLISM

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders, Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia), Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline, Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV: NUCLEIC ACID METABOLISM AND GENETIC INFORMATION TRANSFER

10 Hours

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

UNIT V: ENZYMES **07 HOURS**

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

Recommended Books (Latest Editions)

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

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4

2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP204T	Pathophysiology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1. Describe about causes of diseases and response of the body for inflammation and wound healing process.
CO2. Summarize pathophysiology of CVS disorders, respiratory and renal disorders
CO3. Compare pathophysiological mechanisms and co-relation of haematological, endocrine, nervous system and GI tract disorders.
CO4. Evaluate pathophysiology of hepatic diseases, cancer and bone disorders.
CO5. Describe pathology of various infectious conditions and can identify various disorders.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO 4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2
CO 5	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**2**

Syllabus

Unit I: **10 Hours**

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

BASIC MECHANISM INVOLVED IN THE PROCESS OF INFLAMMATION AND REPAIR: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

UNIT II: **10 Hours**

CARDIOVASCULAR SYSTEM: Hypertension, congestive heart failure, ischemic heart disease (angina,myocardial infarction, atherosclerosis and arteriosclerosis)

RESPIRATORY SYSTEM: Asthma, Chronic obstructive airways diseases.

RENAL SYSTEM: Acute and chronic renal failure.

UNIT III: **10 Hours**

HAEMATOLOGICAL DISEASES: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

ENDOCRINE SYSTEM: Diabetes, thyroid diseases, disorders of sex hormones

NERVOUS SYSTEM: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.

GASTROINTESTINAL SYSTEM: Peptic Ulcer

UNIT IV **8 Hours**

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

DISEASE OF BONES AND JOINTS: Rheumatoid arthritis, osteoporosis and gout

PRINCIPLES OF CANCER: classification, etiology and pathogenesis of cancer

DISEASES OF BONES AND JOINTS: Rheumatoid Arthritis, Osteoporosis, Gout

PRINCIPLES OF CANCER: Classification, etiology and pathogenesis of Cancer

UNIT V: **7 Hours**

INFECTIOUS DISEASES: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections

SEXUALLY TRANSMITTED DISEASES:AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey;
9. Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
10. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
11. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP205T	Computer Applications in Pharmacy	L-T-P-C: 3-0-0-3

COURSE OBJECTIVES

1. Understand the various types of application of computers in pharmacy
2. Understand the various types of databases
3. Know the various applications of databases in pharmacy.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Summarize various applications of databases in pharmacy
CO2: Describe the management of the database-information gathering, requirement
CO3: Illustrate various applications in clinical studies
CO4: Examine role of bioinformatics in drug discovery
CO5: Evaluate knowledge in planning and managing the projects.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	3	1	1	1	3		1	2			1	
CO 2		2	1	3	3	2	1	2		1	1				
CO 3	2	1	1		1	3	3	1	2	1	2	3	3	2	2
CO 4	2	1		1	1	3	3	1	3		1	1	2	2	2
CO 5	1	3	1	1	3	3	3	3			2			1	1
Average	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**

Syllabus

UNIT – I: NUMBER SYSTEM: 06 Hours

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

CONCEPT OF INFORMATION SYSTEMS AND SOFTWARE:

Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

UNIT –II: WEB TECHNOLOGIES: 06 Hours

Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products, Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III: APPLICATION OF COMPUTERS IN PHARMACY 06 Hours

Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

UNIT – IV: BIOINFORMATICS: 06 Hours

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

UNIT-V: COMPUTERS AS DATA ANALYSIS IN PRECLINICAL DEVELOPMENT: 06 Hours

Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

References (Latest edition):

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

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

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total =75
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 50 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP206T	Environmental Sciences Theory	L-T-P-C: 3-0-0-3

COURSE OBJECTIVES

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe natural resources and use of resources for sustainable lifestyle and conservation

CO2: Illustrate the significance of ecosystem and how Greenhouse gases and their effects on environment.

CO3: Classify various sources of pollution and their control measures.

CO4: Describe law related to environmental protection.

CO5: Support to ethical pharmaceutical manufacturing, evaluation, and waste disposal.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	1	1	2	1	1	1	1	-	1	1	-	1	2	1
CO 2	1	1	1	2	1	1	1	1	-	1	1	-	1		1
CO 3	1	1	1	1	1	1	1	1	-	1	1	-	1	2	1
CO 4	1	1	1	2	1	1	1	1	-	1	1	-	2		1
CO 5	1	1	1	3	1	1	1	1	-	1	1	-	2	1	1
Average	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**-**	**1.4**	**1**	**1**

Syllabus

Unit-I: The Multidisciplinary nature of environmental studies **10 Hours**

Natural Resources, Renewable and non-renewable resources: Natural resources and associated problems

Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

UNIT-II: ECOSYSTEMS **10 Hours**

Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT- III: ENVIRONMENTAL POLLUTION: **10 Hours**

Air pollution; Water pollution; Soil pollution

References (Latest edition):

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

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total =75
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 50 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP207P	Human Anatomy and Physiology II practical	L-T-P-C: 0-0-4-2

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe the various body organ systems using specimen, models, charts.

CO2: Interpret neurological examination and functions of olfactory nerves, special senses, taste visual and reflex activity.

CO3: Correlate the positive and negative homeostatic mechanism by applying various laboratory test.

CO4: Explain the family planning devices and pregnancy diagnostic tests.

COURSE OBJECTIVES

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	1	2	1	1	1	1	1	1	2	2	1	1	1
CO 2	1	1	1	2	1	-	1	1	1	1	2	2	1	1	1
CO 3	1	1	1	2	1	2	1	1	1	1	2	2	1	1	1
CO 4	1	1	1	2	1	1	1	1	1	1	2	2	1	1	1
Average	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

PRACTICALS

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

References (Latest Editions)

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

10. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP208P	Pharmaceutical Organic Chemistry I Practical	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Assess the fundamental**s** of atomic structure, bond, hybridization, and addition compounds.

CO2: Interpret and detect elements and functional groups.

CO3: Apply knowledge in the preparation of the derivative and confirm their compound ny melting and boiling point.

CO4: Construct molecular models.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO 4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1
CO 3	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

PRACTICALS

1. Systematic qualitative analysis of unknown organic compounds like
   - Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
   - Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
   - Solubility test
   - Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.

- Melting point/Boiling point of organic compounds
- Identification of the unknown compound from the literature using melting point/ boiling point.
- Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
- Minimum 5 unknown organic compounds to be analysed systematically.

2. Preparation of suitable solid derivatives from organic compounds
3. Construction of molecular models.

References (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP209P	Biochemistry Practical	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Explain and perform the qualitative and quantitative analysis of carbohydrates and proteins.
CO2: Identify the type of proteins and carbohydrates.

CO3: Examine the blood creatinine, blood sugar and abnormal constituent of urine.

CO4: Describe the role of enzymes and isoenzymes in the field of clinical diagnosis.

PRACTICALS

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

Recommended Books (Latest Editions)

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

11. Practical Biochemistry by Harold Varley.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP210P	Computer Applications in Pharmacy practical	L-T-P-C: 0-0-2-1

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Design a questionnaire using word processing package to gather information about a particular disease and a form in MS Access to store the patient information.
CO2: Create mailing labels, database, invoice table and queries in MS Access.
CO3: Exporting tables, queries, forms and reports to web and XML Pages.
CO4: Design form in MS to view add delete and modify the patient record in database.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	2	2	1	1	1	2	1	1	2	2	2	2	1
CO 2	1	1	2	2	1	1	1	-	1	1	2	2	2	2	1
CO 3	1	1	2	2	1	1	1	2	1	1	2	2	2	2	1
CO 4	1	1	2	2	1	1	1	1	1	1	2	2	2	2	1
Average	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**

Syllabus

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3. Retrieve the information of a drug and its adverse effects using online tools
4. Creating mailing labels Using Label Wizard, generating label in MS WORD
5. Create a database in MS Access to store the patient information with the required fields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database

8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 25 (Practical Exam)
Two Sessional Practical Examination (05) + Continuous Mode (05) = 10 marks
End Semester Practical Examination = 15 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

SEMESTER III

BP301T	Pharmaceutical Organic Chemistry II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Clarify chemistry, method of preparation & chemical reactions benzene, phenols and other aromatic compounds.
- Explain the chemistry of fatty acids and its analysis parameters.
- Introduce to the reaction chemistry of polynuclear and cyclic hydrocarbons.
- Clarify various theories applied to the chemistry of cyclic compounds.

COURSE OUTCOMES

Upon completion of the course the student shall be able to

CO1: Write reactions of benzene and apply the concept of reactivity to the particular reactions of benzene.
CO2: Memorize chemistry phenols, aromatic amines and aromatic acids and their reactions.
CO3: Explain the reactions of fatty acids and their evaluation in terms of specific analytical constants.
CO4: Recollect the synthesis and reactions of polynuclear hydrocarbons and their use in pharmacy.
CO5: Explain the various theories and apply those to the reactions of cycloalkanes.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	1	-	1	-	-	1	1	2	2	-	-	-
CO 2	1		1	1	-	1	-	-	1	1	2	2	-	-	-
CO 3	2	1	1	1	-	1	-	-	-	-	2	2	-	-	-
CO 4	2	1	1	1	-	2	1	1	1	1	1	1	1	1	1
CO 5	1	-	-	1	-	-	-	-	-	-	1	1	-	-	-
Average	**2**	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**2**	**2**	**0**	**0**	**0**

Syllabus

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

UNIT I: BENZENE AND ITS DERIVATIVES **10 Hours**

Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II: PHENOLS* - **10 Hours**

Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

AROMATIC AMINES* -

Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

AROMATIC ACIDS* –

Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III: FATS AND OILS **10 Hours**

Fatty acids – reactions. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV: POLYNUCLEAR HYDROCARBONS: **08 Hours**

Synthesis, reactions, Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V: CYCLO ALKANES* **07 Hours**

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

Reference:

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (10) + Continuous Mode (05) = 15 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP302T	Physical Pharmaceutics I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Provide the basic understandings of various physicochemical properties of drug molecules and principles related thereof.
- Explain the application of these principles for pharmaceutical product development.
- Comprehend the knowledge of principles of chemical kinetics and its use in stability testing of dosage forms
- Demonstrate the use of physicochemical properties in the formulation development and evaluation of dosage forms.

COURSE OUTCOMES

Upon the completion of the course student shall be able to

CO1: Describe the concept of solubility of drug and parameters affecting it.
CO2: Articulate the inter relationships between the physiochemical properties of a drug, states of matter and their application to dosage form design
CO2: Explain the concepts of interfacial phenomenon, and use of surface-active agents in pharmacy.
CO4: Discuss the principles of complexation and protein binding and its thermodynamics
CO5: Recollect the terms like pH, buffering capacity, and various buffers with their application in pharmacy.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	-	2	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2
CO 5	2	1	1	1	1	1	1	1	1	1	2	-	2	1	2

Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**

Syllabus

UNIT-I: Solubility of drugs: 10 Hours

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

UNIT-II: STATES OF MATTER AND PROPERTIES OF MATTER: 10 HOURS

State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

PHYSICOCHEMICAL PROPERTIES OF DRUG MOLECULES:

Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.

UNIT-III: SURFACE AND INTERFACIAL PHENOMENON: 08 HOURS

Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilization, detergency, adsorption at solid interface.

UNIT-IV: COMPLEXATION AND PROTEIN BINDING: 08 HOURS

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

UNIT-V: PH, BUFFERS AND ISOTONIC SOLUTIONS: 07 HOURS

Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Reference:

1. Physical Pharmacy by Alfred Martin

2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam 10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm. Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP303T	Pharmaceutical Microbiology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

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

COURSE OUTCOMES

Upon completion of the subject student shall be able to;

COl: Furnish information about classification and cultivation of microorganism. Identify and classify the bacteria by various techniques.

CO2: Convey the importance of sterilization and explain the methods and evaluation of sterilization techniques.

CO3: Compare and contrast the various structure features, biology & characteristics of microbes.

CO4: Describe the maintenance and design of aspetic areas and its evaluation parameters.

CO5: Discuss the methods of preservation of dosage forms and applications of cell cultures in pharmaceutical industry.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 2	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 3	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 4	2	2	-	1	-	1	2	-	2	1	2	1	2	1	1
CO 5	2	2	-	1	-	1	2	-	2	1	2	1	2	1	1

Average	**2**	**2**	-	**1**	-	**1**	**2**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

Unit I: Introduction **10 Hours**

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

UNIT II: IDENTIFICATION OF BACTERIA **10 Hours**

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

UNIT III: MORPHOLOGY **10 Hours**

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

UNIT IV: DESIGNING OF ASEPTIC AREA **08 Hours**

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

UNIT V: TYPES OF SPOILAGE **07 Hours**

Factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

References

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (10) + Continuous Mode (05) = 15 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical**

95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP304T Pharmaceutical Engineering L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To perform various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

COURSE OUTCOMES

Upon completion of the course student shall be able to-

CO1: Explain the mechanisms for flow of fluids, size reduction and separation. Apply the principle during unit operation.

CO2: Discuss the basics of heat transfer. Application of various evaporators and distillation assemblies in pharmaceutical industries.

CO3: Compare and contrast the applications of various drying and mixing techniques and equipment in pharmaceutical industries.

CO4: Explain the concept, techniques, instruments used for filtration and centrifugation.

CO5: Describe the selection of materials used for design of equipment used in pharmaceutical manufacturing.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	2	2	1	2	2	1	2	2	3	3	3	2	1
CO 2	3	2	1	1	1	2	2	1	2	2	3	3	3	2	1
CO 3	3	2	3	3	1	3	3	1	2	3	3	3	3	3	1
CO 4	3	2	3	2	1	2	2	1	3	2	3	3	3	2	1
CO 5	3	1	1	2	1	1	1	1	1	1	3	3	3	1	1
Average	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**3**	**2**	**1**

Syllabus

UNIT-I: **10 Hours**

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

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

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

- **UNIT-II:** **10 Hours**

Heat transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

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

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

UNIT- III: **08 Hours**

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

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

UNIT-IV: **08 Hours**

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principles & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

- **UNIT- V:** **07 Hours**

Materials of pharmaceutical plant construction, corrosion and its prevention: Factors affecting during materials selected for pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (10) + Continuous Mode (05) = 15 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP305P	Pharmaceutical Organic Chemistry II Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Explain the correct use of various equipment's & safety measures in pharmaceutical chemistry laboratory.

CO2: Identify and assess the oil values.

CO3: Synthesize different organic compounds and describe the mechanism of reaction involved.

CO4: Understand the significance and able to analyze organic compounds qualitatively, synthesis of derivatives.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
Average	**2**	**1**	**1**	**1.25**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

PRACTICALS

1. Experiments involving laboratory techniques
   - Recrystallization
   - Steam distillation
2. Determination of following oil values (including standardization of reagents)
   - Acid value
   - Saponification value
   - Iodine value

3. Preparation of compounds
    - Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
    - 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
    - Acetanilide by halogenation (Bromination) reaction.
    - 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
    - Benzoic acid from Benzyl chloride by oxidation reaction.
    - Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
    - 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
    - Benzil from Benzoin by oxidation reaction.
    - Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
    - Cinnammic acid from Benzaldehyde by Perkin reaction
    - P-Iodo benzoic acid from P-amino benzoic acid

References (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP306P	Physical Pharmaceutics I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Develop skills and design techniques of pharmaceutical procedures through the actual use of equipment and instruments.

CO2: Apply theoretical concepts learned in physical pharmaceutics-I.

CO3: Interpret critical solution temperature (CST) & effect of addition of electrolyte on CST of phenol-water system, solubility, partition coefficient, molecular weight, heat of solution of given compound.

CO4: Examine the effect of temperature, pH, solvent, co-solvent on solubility.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	-	1	1	1	1	1	1	2	2	2	1	1
CO 2	2	1	1	2	1	1	1	1	1	1	2	2	-	1	1
CO 3	2	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 4	2	1	1	-	1	1	1	1	1	1	2	2	-	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**

CATALOG DESCRIPTION

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method

8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

References (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP307P	Pharmaceutical Microbiology Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Explain the principle, construction and working of various instruments and perform their operations and skill to handle microscope for observation of microbes.

CO2: Describe and apply the various techniques of sterilization as well as preparation of nutrient broth, nutrient agar, slants, stabs and plates and demonstrate the staining methods.

CO3: Develop skills of Isolating and counting microorganism and perform microbiological assays of antibiotics.

CO4: Apply the technique involved in motility determination, sterility of pharmaceuticals, bacteriological analysis of water and biochemical tests.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 2	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 3	2	2	-	1	-	1	2	-	-	-	-	-	-	-	-
CO 4	2	2	-	1	-	1	2	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	**1**	-	**1**	**2**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

PRACTICALS

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.

4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

References (Latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP308P	Pharmaceutical Engineering Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

CO1: Experiment to determine the radiation constant of brass, iron, unpainted and painted glass and calculate the efficiency of steam distillation.

CO2: Describe and apply the various techniques to determine the overall heat transfer coefficient, moisture content, loss on drying and humidity of air.

CO3: Develop skills of designing the pharmaceutical machinery and evaluate the size distribution of tablet granulation and techniques of size reduction.

CO4: Demonstrate the principle, working and construction of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and explain the factors affecting rate of filteration, evaporation and crystallization.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	-	1	1	1	1	1	2	2	3	-	3	1
CO 2	2	1	1	2	1	1	1	1	1	2	2	-	2	2	1
CO 3	2	1	1	-	1	1	1	1	1	2	2	3	2	-	1
CO 4	2	1	1	2	1	1	1	1	1	2	2	2	2	3	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	2	**1**

PRACTICALS

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
4. Construction of drying curves (for calcium carbonate and starch).
5. Determination of moisture content and loss on drying.
6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.

7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
8. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic andlogarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
12. To study the effect of time on the Rate of Crystallization.
13. To calculate the uniformity Index for given sample by using Double Cone Blender.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

SEMESTER IV

BP401T	Pharmaceutical Organic Chemistry III	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. To understand the chemical properties of organic compounds and their synthesis.
2. Explain the basic principles, theories, classification and chemical reactions involved in stereo chemistry of organic compounds.
3. To understand medicinal properties and other applications of organic compounds.

COURSE OUTCOMES

At the end of the course, the student shall be able to

CO1: Explain the chemical properties of heterocyclic/heteroaromatic compounds.
CO2: Understanding the concept of stereoisomerism and its implication to organic chemistry.
CO3: Understand geometrical isomerism and its conformations in organic chemistry.
CO4: Write various reagents used and important named reactions.
CO5: Recollect synthesis and medicinal use of important heteroaromatic compounds.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	-	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 3	-	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO 5	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**

Syllabus

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

UNIT-I: HETEROCYCLIC COMPOUNDS 10 Hours

Nomenclature and classification, Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene, Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene.

UNIT-II: STEREO ISOMERISM 10 Hours

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules, DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute

UNIT-III: GEOMETRICAL ISOMERISM 10 Hours

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

UNIT-IV: REACTIONS OF SYNTHETIC IMPORTANCE 07 Hours

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation

UNIT-V: SYNTHESIS, REACTIONS AND MEDICINAL USE 8 Hours

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

References (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd

5. Heterocyclic Chemistry by T.L. Gilchrist

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP402T	Medicinal Chemistry I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. To know the history and development of medicinal chemistry and physicochemical & pharmacological activity of chemical compounds.
2. To elaborate the drug metabolic pathways, adverse effect and therapeutic value of drugs acting on nervous system and analgesics.
3. Explain the Structural Activity Relationship (SAR) of various drugs classified in nervous system and analgesics.
4. Explain the biosynthesis of drugs used as analgesics and involved in nervous system.

COURSE OUTCOMES

Upon completion of the course the student shall be able to

CO1: Understand the historical development, emerging trends, relevance, & significance of medicinal chemistry in drug discovery.

CO2: Discuss the chemical structure, classification, nomenclature, mechanism of actions, and side effects of drugs acting on autonomous and central nervous system.

CO3: Explain the synthesis, metabolism, and uses of drugs acting on autonomous and central nervous system.

CO4: Analyse the structure-activity relationships of drugs acting on autonomous and central nervous system.

CO5: Create the synthetic schemes and metabolic pathways for the selected drugs.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 2	3	1	1	1	1	1	1	1	1	-	2	2	-	1	-
CO 3	3	1	1	1	1	1	-	1	1	1	2	-	2	-	1
CO 4	3	1	1	1	1	1	1	1	1	1	2	2	2	1	1

CO 5	3	1	1	1	1	1	1	1	1	1	-	2	1	1	1
Average	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

Syllabus

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

UNIT- I: INTRODUCTION TO MEDICINAL CHEMISTRY 10 Hours

History and development of medicinal chemistry, physicochemical properties in relation to biological action, Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, optical and Geometrical isomerism.

DRUG METABOLISM

Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II: DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM 10 Hours

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic Agents: SAR of Sympathomimetic Agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III: CHOLINERGIC NEUROTRANSMITTERS 10 Hours

Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic Agents: SAR of Parasympathomimetic Agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

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

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

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

UNIT- IV: DRUGS ACTING ON CENTRAL NERVOUS SYSTEM 08 Hours

Sedatives and Hypnotics:

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

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

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

Antipsychotics

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

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

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

Anticonvulsants:

SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V: DRUGS ACTING ON CENTRAL NERVOUS SYSTEM 07 Hours

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

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

Dissociative anesthetics: Ketamine hydrochloride.*

NARCOTIC AND NON-NARCOTIC ANALGESICS

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

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

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

References:

1. Organic medicinal and Pharmaceutical Chemistry by Wilson and Giswold
2. Burger's Medicinal Chemistry by Burger ,Vol I to IV
3. Foye's Principles of Medicinal Chemistry by William Foye

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3

3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP403T	Physical Pharmaceutics II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Describe various dispersion system, micromeretics and rheology of drug molecules in designing the suitable dosage forms.
- Explain the principles of reaction kinetics & their association with stability testing of formulations.
- Applications of physicochemical properties in the formulation development and evaluation of various dosage forms.

COURSE OUTCOMES

Upon the completion of the course student shall be able to

CO1: Understand the physics and properties of colloidal dispersions.
CO2: Explain the concept of rheology and factors affecting it.
CO3: Discuss characteristics of suspension and emulsions.
CO4: Understand particle characteristics and their implication in pharmacy.
CO5: Furnish knowledge about reaction kinetics and to use them for stability testing and in determination of self-life of various dosage formulation.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 3	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 4	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 5	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1
Average	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT-I: COLLOIDAL DISPERSIONS: 07 Hours

Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

UNIT-II: RHEOLOGY: 10 Hours

Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

DEFORMATION OF SOLIDS: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III: COARSE DISPERSION: 10 Hours

Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV: MICROMERETICS: 10 Hours

Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V: DRUG STABILITY: 10 Hours

Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention

References:

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics byEugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP404T	Pharmacology I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Familiarize with basic concepts of pharmacology.
2. To describe the therapeutic actions of different categories of drugs
3. Discuss the mechanism of action of drug at sub cellular or macromolecular levels.
4. Application of the basic pharmacological knowledge in the prevention and treatment of various diseases.

COURSE OUTCOMES

Upon completion of this course, the student should be able to

CO1: Explain basic pharmacological knowledge and concept in the diagnosis and prevention and treatment.
CO2: Understand the pharmacodynamics and adverse drug reactions.
CO3: Explain the principles, mechanism and classification of drug acting on peripheral nervous system.
CO4: Furnishing the action of drugs on central nervous system especially neurotransmission.
CO5: Learn pharmacodynamics of psychopharmacological agents.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	1	2	-	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	1	2	1	2	1	1

CO 5	2	1	1	1	1	1	1	1	1	1	2	-	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

UNIT-I: GENERAL PHARMACOLOGY **08 Hours**

Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and noncompetitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II: GENERAL PHARMACOLOGY **12 Hours**

Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

ADVERSE DRUG REACTIONS

Drug interactions (pharmacokinetic and pharmacodynamic) Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT-III: PHARMACOLOGY OF DRUGS ACTING ON PERIPHERAL NERVOUS SYSTEM

10 Hours

Organization and function of ANS. Neurohumoral transmission,co-transmission and classification of neurotransmitters. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in myasthenia gravis and glaucoma

UNIT-IV: PHARMACOLOGY OF DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

08 Hours

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

UNIT-V: PHARMACOLOGY OF DRUGS ACTING ON CENTRAL NERVOUS SYSTEM

07 Hours

Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. Drugs used in Parkinsons disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists. Drug addiction, drug abuse, tolerance and dependence.

References:

1. The Pharmacological Basis of Therapeutics by Goodman and Gilman
2. Rang and Dale's Pharmacology by Rang H. P., Dale M. M., Ritter J. M., Flower R. J.
3. Essentials of Medical Pharmacology by K.D.Tripathi published by JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
4. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill**.**
5. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
6. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews Pharmacology.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4

2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP405T	Pharmacognosy and Phytochemistry I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Explain the history and scope of pharmacognosy.
2. To discuss the origin of drug and their cultivation techniques.
3. Elaborate the production, collection, storage and preservation of natural crude drugs.
4. To know the techniques of quality control for the herbal drugs.
5. To discuss the metabolites and pharmacognosy in medicine.

COURSE OUTCOMES

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

CO1: Describe the foundations of herbal raw material classification and identification
CO2: Analyze, create, and evaluate various quality control measures for herbal medicines.
CO3: Execute various methods for conservation of medicinal plants
CO4: Discuss the use of herbal remedies in medical systems.
CO5: Develop approaches for preparing herbal raw materials for pharmaceuticals

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	2	1	2	-	1	1
CO 3	2	1	1	1	1	1	1	1	1	2	-	2	1	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	1	1	1	1	1	1	2	1	2	-	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT-I: 10 hours

Introduction to Pharmacognosy: Definition, history, scope and development of Pharmacognosy, Sources of Drugs – Plants, Animals, Marine & Tissue culture, Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of drugs of natural origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II: 10 Hours

Cultivation, collection, processing and storage of drugs of natural origin Cultivation and Collection of drugs of natural origin, Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants, Conservation of medicinal plants.

UNIT-III: 07 Hours

Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy, Edible vaccines.

UNIT IV: 10 Hours

Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.

UNIT V: 08 Hours

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant products: Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens

Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax Marine Drugs: Novel medicinal agents from marine sources

References:

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis.
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae 9. Anatomy of Crude Drugs by M.A. Iyengar

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3

3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP406P	Medicinal Chemistry I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Synthesize the drugs, their intermediates and able to understand the mechanism of reaction involved in each synthesis.
CO2: Perform the assay of drugs.
CO3: Explain the techniques involved in the determination of partition coefficient of drugs.
CO4: Perform the purification of drugs.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	2	1	1	1	-	1	1	2	-	2	1	2
CO 3	2	1	1	-	1	1	1	1	1	-	2	2	-	1	2
CO 4	2	1	1	2	1	-	1	1	1	1	-	2	2	1	-
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

PRACTICALS

1. **PREPARATION OF DRUGS/ INTERMEDIATES**

   1, 3-pyrazole, 1,3-oxazole, Benzimidazole, Benztriazole, 2,3- diphenyl, quinoxaline, Benzocaine,

   Phenytoin, Phenothiazine, Barbiturate

2. **ASSAY OF DRUGS**

Chlorpromazine, Phenobarbitone, Atropine, Ibuprofen, Aspirin, Furosemide

3. **DETERMINATION OF PARTITION COEFFICIENT FOR ANY TWO DRUGS**

References (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP407P	Physical Pharmaceutics II Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Evaluate surface tension, viscosity, specific surface area, particle size distribution of given material by applying different methods.

CO2: Identify and determine the type of density, angle of repose and effect of lubricant on angle of repose.

CO3: Define suspending agents and determine the sedimentation volume.

CO4: Examine the order of reaction and accelerated stability studies.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	1	2	1	1	1	1	1	1	2	3	3	1	1
CO 2	3	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 3	3	1	1	2	1	1	1	1	1	1	2	2	2	1	1
CO 4	3	1	1	2	1	1	1	1	1	1	2	1	1	1	1
Average	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. **Particle size analysis:** Determination of particle size, particle size distribution using sieving method.
2. **Particle size analysis:** Determination of particle size, particle size distribution using microscopic method.
3. **Particle size analysis:** Determination of bulk density, true density and porosity.

4. **Particle size analysis:** Determine the angle of repose and influence of lubricant on angle of repose.
5. **Viscosity determination:** Determination of viscosity of liquid using Ostwald's viscometer.
6. **Suspension analysis:** Determination of sedimentation volume with effect of different suspending agent.
7. **Suspension formulation:** Determination sedimentation volume with effect of different concentration of single suspending agent.
8. **Viscosity determination:** Determination of viscosity of semisolid by using Brookfield viscometer.
9. **Rate constant determination:** Determination of reaction rate constant first order, Determination of reaction rate constant second order.
10. **Stability studies:** Accelerated stability studies.

References (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5

3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP408P	Pharmacology I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Identify the commonly used instruments and laboratory animals, their maintenance as per CPCSEA guidelines in experimental pharmacology.

CO2: Explain the common laboratory techniques like blood withdrawal and routes of drug administration in laboratory animals.

CO3: Examine the effect of various drugs on ciliary motility of frog, rabbit eye, skeletal muscle, locomotor activity.

CO4: Determine the effect of anticonvulsant, anti-catatonic, anxiolytic and anesthetic effect of drugs using simulated experiments by softwares and videos.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1
CO 2	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1
CO 3	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1
CO 4	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1
Average	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1

PRACTICALS

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.

6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

References (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP409P	Pharmacognosy and Phytochemistry I Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

CO1: Differentiating and identifying herbal basic materials
CO2: Identify and support the quality of herbal raw materials.
CO3: Design and suggest several analytical tools for extraction technique
CO4: Evaluate and verify several chromatographic methods for analyzing raw herbal materials**.**

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

Semester V

BP501T	Medicinal Chemistry II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship of different class of drugs
- Study the chemical synthesis of selected drugs

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Define, classify and list the pharmacological uses of drugs acting on (i) Gastro-intestinal tract (H2-receptor antagonists & proton pump inhibitors), (ii) Cardio-vascular system and (iii) endocrine system along with drugs under the class (iv) anticancer agents, (v) antihistamines (H1-receptor antagonists) and (vi) local anaesthetics

CO2: Summarize mode of action and structure activity relationship for the major chemical class under each category of drugs listed under CO1

CO3: Identify & construct structure of drugs from IUPAC nomenclature & vice-versa and elaborate the synthetic pathway for few important drugs specified under each category listed under CO1

CO4: Understand the Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs under each category listed under CO1

CO5: Explain the biotransformation of important drugs under each category listed under CO1

Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
CO 2	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
CO 3	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
CO 4	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
CO 5	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
Average	1	**1**	**1**	1	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

Study of the development of the following classes of drug's classification, mechanism of action, uses of drugs mentioned in the course, structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I: 10 HOURS

ANTIHISTAMINIC AGENTS:: Histamine, receptors and their distribution in the humanbody H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

ANTI-NEOPLASTIC AGENTS:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II: ANTI-ANGINAL: 10 HOURS

VASODILATORS: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

CALCIUM CHANNEL BLOCKERS: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

DIURETICS: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

ANTI-HYPERTENSIVE AGENTS: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine

monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III: 10 HOURS

ANTI-ARRHYTHMIC DRUGS: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.

ANTI-HYPERLIPIDEMIC AGENTS: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

COAGULANT & ANTICOAGULANTS: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

DRUGS ACTING ON CONGESTIVE HEART FAILURE: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan

UNIT- IV: DRUGS ACTING ON ENDOCRINE SYSTEM 08 HOURS

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V: ANTIDIABETIC AGENTS: 07 HOURS

Insulin and its preparations

Sulfonyl Ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

Miscellaneous: Phenacaine, Diperodon, Dibucaine*

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP502T	Industrial Pharmacy I	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know the various pharmaceutical dosage forms and their manufacturing techniques.
- Know various considerations in development of pharmaceutical dosage forms.
- Formulate solid, liquid, and semisolid dosage forms and evaluate them for their quality.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Able to define Preformulation and analyze the physicochemical characteristics of drug substances.
CO2: Understand the various pharmaceutical dosage forms and their manufacturing techniques.
CO3: Understand the various considerations in the development of pharmaceutical dosage forms.
CO4: Formulate and evaluate the solid, liquid and semisolid dosage forms.
CO5: Plan and Employ the concept of cosmetic in formulation, packaging and evaluation of cosmetic preparations

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 4	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
CO 5	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	-	**1**	**1**	**1**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

UNIT-I: **07 Hours**

PREFORMULATION STUDIES:

Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

PHYSICAL PROPERTIES:

Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

CHEMICAL PROPERTIES:

Hydrolysis, oxidation, reduction, racemization, polymerization BCS classification of drugs & its significant. Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and their impact on stability of dosage forms.

UNIT-II: **10 Hours**

TABLETS:

Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipements and tablet tooling.

Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

Quality control tests: In process and finished product tests

LIQUID ORALS:

Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-III: **08 Hours**

CAPSULES:

Hard gelatin capsules: Introduction, production of hard gelatin capsule shells. Size of capsules, filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.

Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

Pellets: Introduction, formulation requirements, pelletization process, equipment for manufacture of pellets.

UNIT-IV: **10 Hours**

PARENTERAL PRODUCTS

Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity.

Production procedure, production facilities and controls, aseptic processing.

Formulation of injections, sterile powders, large volume parenteral and lyophilized products.

Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations

UNIT-V **10 Hours**

COSMETICS: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, toothpastes, hair dyes and sunscreens.

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

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

References:

1. Pharmaceutical dosage forms - Tablets, Vol 1 – 3. Edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz. Marcel Dekker: New York.
2. Pharmaceutical dosage forms: Parenteral medication Vol 1 & 2. Edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz. Marcel Dekker: New York.
3. Pharmaceutical dosage form: Disperse systems. Vol – 1. Edited by Herbert Lieberman, Martin Rieger, Gilbert S. Banker
4. Modern Pharmaceutics. Edited by Gilbert S. Banker, Juergen Siepmann, Christopher Rhodes, 4th Edition. 2002. CRC Press.
5. Remington: The Science and Practice of Pharmacy, 23rd Edition 2020. Pharmaceutical Science (RPS). Elsevier Inc.
6. Theory and Practice of Industrial Pharmacy by Leon Lachman, Herbert A. Lieberman, Joseph L. Kanig.

7. Pharmaceutics- The science of dosage form design by M. E. Aulton, Churchill Livingstone, Latest edition
8. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems by Loyd V. Allen, Timothy B. McPherson. 12th edition, 2021. Wolters Kluwer Health.
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP503T	Pharmacology II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Understand isolation of different organs/tissues from the laboratory animals by simulated experiments
- Understand various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Identify and explain the mechanism of drug action and its relevance in the treatment of different diseases.

CO2: Describe the pharmacology of drugs, their uses, adverse effects and contraindications.

CO3: Perform various in-vitro experiments to demonstrate receptor actions using isolated tissue preparation.

CO4: Understand the effect of drugs on physiological systems.

CO5: Appreciate correlation of pharmacology with related medical sciences

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	1	1	2	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	1	1	2	1	1	1	1	2	2	-	1	2
CO 3	2	1	1	1	1	2	1	1	1	1	2	2	2	1	2
CO 4	2	1	1	1	1	2	1	1	1	1	2	2	2	-	2
CO 5	2	1	1	1	1	2	1	1	1	1	2	2	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT-I:

PHARMACOLOGY OF DRUGS ACTING ON CARDIOVASCULAR SYSTEM

10 HOURS

a. Introduction to hemodynamic and electrophysiology of heart
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs
d. Anti-anginal drugs
e. Anti-arrhythmic drugs
f. Anti-hyperlipidaemic drugs

UNIT-II: PHARMACOLOGY OF DRUGS ACTING ON CARDIO VASCULAR SYSTEM

10 HOURS

a. Drug used in the therapy of shock
b. Hematinics, coagulants and anticoagulants
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders

PHARMACOLOGY OF DRUGS ACTING ON URINARY SYSTEM

a. Diuretics
b. Anti-diuretics

UNIT-III: AUTOCOIDS AND RELATED DRUGS **10 HOURS**

a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists
c. Prostaglandins, Thromboxanes and Leukotrienes
d. Angiotensin, Bradykinin and Substance P
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

UNIT-IV: PHARMACOLOGY OF DRUGS ACTING ON ENDOCRINE SYSTEM **8 HOURS**

a. Basic concepts in endocrine pharmacology
b. Anterior Pituitary hormones- analogues and their inhibitors
c. Thyroid hormones- analogues and their inhibitors
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D
e. Insulin, Oral Hypoglycemic agents and glucagon
f. ACTH and corticosteroids

UNIT-V: PHARMACOLOGY OF DRUGS ACTING ON ENDOCRINE SYSTEM

07 HOURS

a. Androgens and Anabolic steroids
b. Estrogens, progesterone and oral contraceptives
c. Drugs acting on the uterus

BIOASSAY

a. Principles and applications of bioassay

b. Types of bioassay
c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT

References:-

1. The Pharmacological Basis of Therapeutics by Goodman and Gilman
2. Rang and Dale's Pharmacology by Rang H. P., Dale M. M., Ritter J. M., Flower R. J.
3. Essentials of Medical Pharmacology by K.D.Tripathi published by JAYPEE Brothers Medical
   Publishers (P) Ltd, New Delhi
4. Basic and clinical pharmacology by Katzung B. G., Masters S. B., Trevor A. J., published by Tata Mc Graw-Hill.
5. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
6. Goodman and Gilman's, The Pharmacological Basis of Therapeutics.
7. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
8. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews Pharmacology.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	4	2

90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP504T	Pharmacognosy and Phytochemistry II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- To know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
- To understand the preparation and development of herbal formulation.
- To understand the herbal drug interactions
- To carryout isolation and identification of phytoconstituents

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe numerous basic biosynthetic principles and secondary metabolites with medicinal significance.
CO2: Categorize biochemical routes according to secondary metabolites.
CO3: Summarize and analyze phytopharmaceuticals are used in the health care system.
CO4: Develop numerous herbal formulation and guiding concepts
CO5: Understand modern techniques of extraction and apply for Pharmaceutical & industrial applications.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 2	2	1	1	3	1	1	1	1	1	2	2	2	2	1	1
CO 3	2	1	1	3	1	1	1	1	1	2	2	2	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	2	1	1	1	1	1	2	2	2	2	1	1
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT-I: METABOLIC PATHWAYS IN HIGHER PLANTS AND THEIR DETERMINATION

07 Hours

a. Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14 Hours**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III: ISOLATION, IDENTIFICATION AND ANALYSIS OF PHYTOCONSTITUENTS

06 Hours

1. **Terpenoids**: Menthol, Citral, Artemisin
2. **Glycosides**: Glycyrhetinic acid & Rutin
3. **Alkaloids**: Atropine, Quinine, Reserpine, Caffeine
4. **Resins**: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V: **8 Hours**

Basics of Phytochemistry: Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

References:

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit. 13. Text Book of Biotechnology by R.C. Dubey.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP505T	Pharmaceutical Jurisprudence	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
- Various Indian pharmaceutical Acts and Laws
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- The code of ethics during the pharmaceutical practice

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the basic principles, purpose, dimensions, significance and relevance of pharmaceutical laws in India.

CO2: Understand the various Indian Pharmaceutical Acts and Laws governing the manufacturing, sale, research & usage of drugs.

CO3: Explain the definitions in the Act, and Identify potential fraud and abuse legal issues of narcotic & psychotropic substance.

CO4: Explain the significance of Schedule M and Schedule Y related manufacturing & clinical trials.

CO5: Learn about Patents, procedure for patent application and IPR.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	1	1	2	3	1	2	1	3	3	1	2	1
CO 2	2	1	1	1	1	2	3	1	2	1	3	3	1	2	1
CO 3	2	1	1	1	1	2	3	1	2	1	3	3	-	1	1
CO 4	3	1	1	1	1	2	3	1	2	1	3	2	1	2	1
CO 5	2	1	1	1	1	2	3	1	2	1	3	3	1	2	-
Average	**2**	**1**	**1**	**1**	**1**	**2**	**3**	**1**	**2**	**1**	**3**	**3**	**1**	**2**	**3**

Syllabus

UNIT-I: DRUGS AND COSMETICS ACT, 1940 AND ITS RULES 1945: 10 Hours

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II: DRUGS AND COSMETICS ACT, 1940 AND ITS RULES 1945. 10 Hours

Detailed study of Schedule G, H, M, N, P, T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III: PHARMACY ACT –1948: 10 Hours

Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV: STUDY OF SALIENT FEATURES OF DRUGS AND MAGIC REMEDIES ACT AND ITS RULES 08 Hours

Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).

UNIT-V: PHARMACEUTICAL LEGISLATIONS – 07 Hours

A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath.

Medical termination of pregnancy act

Right to information act

Introduction to intellectual property rights (IPR)

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory).

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP506P	Industrial Pharmacy I Lab	L-T-P-C: 0-0-4-2

Course Outcome

Upon completion of this course, students will be able to:

CO1: Explain the correct use of various equipments used in Pharmaceutics laboratory relevant to tablets, capsules and pharmaceutical preparations.

CO2: Formulate, evaluate, and label tablets, capsules, creams, eye drops, ointments.

CO3: Learn the rationale behind use of various formulation ingredients

CO4: Design labels to suit regulatory requirements and evaluate glass containers.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	2	-	-	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	-	1	2	1	-	-	-	-	-	-	-	-
CO 3	1	2	-	-	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	-	1	2	1	-	2	1	2	1	2	1	1
Average	**1**	**2**	-	-	**1**	**2**	**1**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

PRACTICALS

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Quality control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, Vol 1 – 3. Edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz. Marcel Dekker: New York.
2. Pharmaceutical dosage forms: Parenteral medication Vol 1 & 2. Edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz. Marcel Dekker: New York.
3. Pharmaceutical dosage form: Disperse systems. Vol – 1. Edited by Herbert Lieberman, Martin Rieger, Gilbert S. Banker
4. Modern Pharmaceutics. Edited by Gilbert S. Banker, Juergen Siepmann, Christopher Rhodes, 4th Edition. 2002. CRC Press.
5. Remington: The Science and Practice of Pharmacy, 23rd Edition 2020. Pharmaceutical Science (RPS). Elsevier Inc.
6. Theory and Practice of Industrial Pharmacy by Leon Lachman, Herbert A. Lieberman, Joseph L. Kanig.
7. Pharmaceutics- The science of dosage form design by M. E. Aulton, Churchill Livingstone, Latest edition
8. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems by Loyd V. Allen, Timothy B. McPherson. 12th edition, 2021. Wolters Kluwer Health.
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP507P	Pharmacology II Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

CO1: Explain the in-vitro and in-vivo pharmacology and use of physiological salt solution.
CO2: Analyze the effect of drugs on various organs of the laboratory animals.
CO3: Experiment the bioassay of drug by various methods and calculate the PA2 and PD2 value.
CO4: Examine the pharmacological activity of drugs using animal models.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	2	1	1	2	2	1	1s	1
CO 2	2	1	1	1	1	1	2	3	1	1	2	2	1	1	1
CO 3	2	1	1	2	1	1	2	1	1	1	2	2	1	-	1
CO 4	2	1	1	1	1	1	2	3	2	1	2	2	1	2	1
Average	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

PRACTICALS

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD2 value using guinea pig ileum.

13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

Note: *All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP508P	Pharmacognosy and Phytochemistry II Lab	L-T-P-C: 0-0-4-2

Course Outcome

Upon completion of this course, students will be able to:

CO1: Establish and demonstrate several methods for processing and inspecting the quality of raw herbal ingredients.

CO2: Describe the uses of botanical raw materials in the pharmaceutical business.

CO3: Differentiate and support the various formulation preparation methods

CO4: Compute several methods for processing and assessing the quality of herbal raw materials.

CO5: Develop formulations for phytopharmaceuticals and suggest various methods for isolation.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	1	2	-	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	1	2	2	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	-	2	-	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**

PRACTICALS

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
    a. Caffeine - from tea dust.
    b. Diosgenin from Dioscorea
    c. Atropine from Belladonna
    d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

SEMESTER VI

BP601T	Medicinal Chemistry III	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the importance of drug design and different techniques of drug design.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Define, classify, and list out the pharmacological uses of chemotherapeutic agents; understand the basic approaches, protocols, and applications of Drug Design and Combinatorial Chemistry in medicinal chemistry.

CO2: Discuss the chemical structure, nomenclature, mechanism of actions, uses, and side effects of the major chemical classes of chemotherapeutic agents; describe the influence of physicochemical parameters in drug's action.

CO3: Identify & construct the chemical structure of drugs from IUPAC nomenclature & vice-versa and explain the synthesis of important drugs as chemotherapeutic agents.

CO4: Analyse the structure Activity Relationships (SAR) of important drugs as chemotherapeutic agents and design new potential medications of the selected drugs using pro-drug and other drug design approaches.

CO5: Create the synthetic schemes and metabolic pathways for the selected drugs.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO 4
CO 1	1	1	1	1	1	1	1	2	2	1	2	2	2	1	2
CO 2	1	1	1	1	1	1	1	2	2	1	2	2	2	-	2
CO 3	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2
CO 4	1	1	1	1	1	1	1	2	2	1	2	2	2	-	2

CO 5	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2
Average	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

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

UNIT – I: ANTIBIOTICS **10 HOURS**

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

β-Lactam antibiotics: Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II: ANTIBIOTICS (CONTINUED) **10 Hours**

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III: **10 Hours**

ANTI-TUBERCULAR AGENTS

Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti-tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.

URINARY TRACT ANTI-INFECTIVE AGENTS

Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

ANTIVIRAL AGENTS:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT – IV: ANTIFUNGAL AGENTS: 08 Hours

ANTIFUNGAL ANTIBIOTICS: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

ANTI-PROTOZOAL AGENTS: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

ANTHELMINTICS: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

SULPHONAMIDES AND SULFONES

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V: 07 Hours

INTRODUCTION TO DRUG DESIGN

Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.

COMBINATORIAL CHEMISTRY:

Concepts and applications of combinatorial chemistry: solid phase and solution phase synthesis.

Reference and Textbooks:-

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.129

7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP602T	Pharmacology III	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
- Comprehend the principles of toxicology and treatment of various poisonings and
- Appreciate correlation of pharmacology with related medical sciences.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the classification, mechanism of action, pharmacological actions, pharmacokinetics, therapeutic uses, adverse effects, drug interactions, contraindications, dosages of drugs acting on respiratory and GI system.

CO2: Explain the pharmacology and pharmacotherapy of drugs used in infectious diseases.

CO3: Understand the pharmacology of immunosuppressant's and immunostimulants with related medical science.

CO4: Define and distinguish the various types of toxicity and its treatment and management.

CO5: Understand the basic principle of biological clock and their significance leading to chronotherapy.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	2	1	2	2	1	2	1
CO 2	2	1	1	1	1	1	1	1	2	1	2	2	1	2	1
CO 3	2	1	1	1	1	1	1	1	2	1	2	2	1	-	1
CO 4	2	1	1	1	1	1	1	1	2	1	2	2	1	2	1
CO 5	2	1	1	1	1	1	1	1	2	1	2	2	1	2	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**1**

Syllabus

UNIT-I: PHARMACOLOGY OF DRUGS ACTING ON RESPIRATORY SYSTEM

10 Hours

Anti -asthmatic drugs, Drugs used in the management of COPD, Expectorants and antitussives, Nasal decongestants, Respiratory stimulants

PHARMACOLOGY OF DRUGS ACTING ON THE GASTROINTESTINAL TRACT

Antiulcer agents. Drugs for constipation and diarrhea, Appetite stimulants and suppressants, Digestants and carminatives, Emetics and anti-emetics.

UNIT-II: CHEMOTHERAPY **10 Hours**

General principles of chemotherapy, Sulfonamides and cotrimoxazole, Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III: CHEMOTHERAPY **10 Hours**

Antitubercular agents, Antileprotic agents, Antifungal agents, Antiviral drugs, Anthelmintics, Antimalarial drugs, Antiamoebic agents

UNIT-IV: CHEMOTHERAPY **08 Hours**

Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.

IMMUNOPHARMACOLOGY

- Immunostimulants
- Immunosuppressant

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

UNIT-V: PRINCIPLES OF TOXICOLOGY **07 Hours**

- Definition and basic knowledge of acute, subacute and chronic toxicity.
- Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity
- General principles of treatment of poisoning
- Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning.

CHRONO PHARMACOLOGY

Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

Reference and Textbooks:-

1. The Pharmacological Basis of Therapeutics by Goodman and Gilman
2. Rang and Dale's Pharmacology by Rang H. P., Dale M. M., Ritter J. M., Flower R. J.
3. Essentials of Medical Pharmacology by K.D.Tripathi published by JAYPEE Brothers Medical
4. Publishers (P) Ltd, New Delhi
5. Basic and clinical pharmacology by Katzung B. G., Masters S. B., Trevor A. J., published by Tata Mc Graw-Hill.
6. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.
7. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins.
8. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews Pharmacology.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP603T	Herbal Drug Technology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the various step involved in the cultivation and processing of raw material as a source of herbal drugs and understand the difficulties in standardization of herbal material, new approaches evolved, and steps in development of herbal monograph.

CO2: Understand the significance and need of plant material authentication and various approaches used in the preparation of herbal and ayurvedic formulations.

CO3: Explain the philosophical basis, concept of health and pathogens, diagnosis and treatment aspects of Ayurveda, Unani, Siddha and Homoepathic system of medicine.

CO4: Describe the concept of nutraceuticals and functional foods as dietary supplements and identify their herb drug and herb food interactions.

CO5: Explain the patenting and regulatory requirement of natural products and manufacturing practices related to Indian System of Medicines.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	2	1	2	2	2	1	2	2	1
CO 2	2	1	1	2	1	1	2	1	2	2	2	2	2	2	3
CO 3	2	1	1	2	1	1	2	1	2	2	2	1	2	2	1
CO 4	2	1	1	2	1	1	2	1	2	2	2	1	2	2	2
CO 5	2	1	1	2	1	1	2	1	2	2	2	-	-	-	3
Average	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**2**

Syllabus

UNIT-I: HERBS AS RAW MATERIALS **11 Hours**

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs, Selection, identification and authentication of herbal materials. Processing of herbal raw material

BIODYNAMIC AGRICULTURE

Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

INDIAN SYSTEMS OF MEDICINE

Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT-II: NUTRACEUTICALS **7 Hours**

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III: HERBAL COSMETICS **10 Hours**

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

HERBAL EXCIPIENTS:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

HERBAL FORMULATIONS:

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT- IV: EVALUATION OF DRUGS **10 Hours**

WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

PATENTING AND REGULATORY REQUIREMENTS OF NATURAL PRODUCTS:

Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy. Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT-V: GENERAL INTRODUCTION TO HERBAL INDUSTRY **07 Hours**

Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives

Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

Reference and Textbooks:-

1. Trease and Evans Pharmacognosy by W.C.Evans published by W.B. Sounders & Co., London
2. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae published by Nirali Prakashan
3. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals by Mukherjee, P.W. published by Business Horizons Publishers, New Delhi.
4. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).
5. Textbook of Pharmacognosy by Tyler, Brady & Robber.
6. Essential of Pharmacognosy by Dr.S.H.Ansari.
7. Pharmacognosy & Phytochemistry by V.D.Rangari.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP604T	Biopharmaceutics and Pharmacokinetics	L-T-P-C: 3-3-0-4

COURSE OBJECTIVES

- Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
- Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
- To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
- Understand various pharmacokinetic parameters, their significance & applications.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the basic concept used in biopharmaceutics, *In - vitro* testing models for pharmacokinetic studies and correlation of *In-vitro*- and *In–vivo* studies.

CO2: Understand the significance of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination

CO3: Learn the objectives of bioavailability, bioequivalence of drugs products, concept and measurements of bio-availability.

CO4: Student will be able to elaborate the concept of compartment modelling studies and understand the concept of linear and non-linear pharmacokinetics.

CO5: Explain the various pharmacokinetic parameters, their significance & applications.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2

CO 5	2	1	1	1	1	1	1	1	1	1	2	1	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**

Syllabus

UNIT-I: INTRODUCTION TO BIOPHARMACEUTICS **10 Hours**

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes,

Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II: **10 Hours**

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT- III: **10 HOURS**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE ,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application

UNIT- IV **08 HOURS**

Multicompartment Models: Two compartment open model. IV bolus

Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

UNIT- V **07 HOURS**

Nonlinear Pharmacokinetics

Introduction, Factors causing Non-linearity, Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP605T	Pharmaceutical Biotechnology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Define biotechnology and understand the interlink of biotechnology with pharmaceutical science by using living organisms.

CO2: Student will be able to comprehend the concept of enzymes and their uses by immobilization, working applications of biosensors in Pharmaceutical Industries.

CO3: Student will be able to describe the basics of genetic engineering applications in pharmaceuticals and understand transgenic animals and biological products including monoclonal antibodies.

CO4: Student will be able to report the concept of rDNA technology and hybridoma technology.

CO5: Understand the types of immunity and general method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Appreciate the use of microorganisms in fermentation technology.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	1	1	1	1	1	2	1	2	-	1	1
CO 2	2	1	1	2	1	1	1	1	1	1	1	2	-	1	1
CO 3	2	1	1	-	1	1	1	1	1	-	1	2	-	1	1
CO 4	2	1	1	1	1	1	1	1	1	-	1	2	-	1	1
CO 5	2	1	1	-	1	1	1	1	1	2	1	2	-	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**-**	**1**	**1**

Syllabus

UNIT I **10 HOURS**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
f) Basic principles of genetic engineering.

UNIT II **10 HOURS**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the production of: Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
d) Brief introduction to PCR

UNIT III **10 HOURS**

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins.
b) Structure and Function of MHC.
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines.
f) Hybridoma technology- Production, Purification and Applications.
g) Blood products and Plasma Substituties.

UNIT IV **08 HOURS**

a) Immuno blotting techniques- ELISA.
b) Western blotting, Southern blotting.
c) Genetic organization of Eukaryotes and Prokaryotes,
d) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.

e) Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants.

UNIT V **07 HOURS**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
b) Large scale production fermenter design and its various controls.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin.
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. RA Goldshy et. al., : Kuby Immunology.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP606T	Pharmaceutical Quality Assurance	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the cGMP aspects in a pharmaceutical industry
- Appreciate the importance of documentation
- Understand the scope of quality certifications applicable to pharmaceutical industries
- Understand the responsibilities of QA & QC departments

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Understand the significance of quality in pharmaceutical manufacturing.
CO2: Explain the concept of Current Good Manufacturing Practices (cGMP) in pharmaceutical industries.
CO3: Learn importance of documentation, SOPs and records.
CO4: Explain and elaborate the role of validation in assurance of quality in pharmaceutical industry.
CO5: Understand the scope of quality certification and role and responsibilities of QA, QC departments.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
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CO 3	2	1	1	1	1	1	1	1	1	-	2	2	-	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

Syllabus

UNIT – I: **10 Hours**

QUALITY ASSURANCE AND QUALITY MANAGEMENT CONCEPTS:

Definition and concept of Quality control, Quality assurance and GMP.

Total Quality Management (TQM): Definition, elements, philosophies.

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines.

Quality by design (QbD): Definition, overview, elements of QbD program, tools.

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration.

NABL accreditation : Principles and procedures.

UNIT – II: **10 Hours**

ORGANIZATION AND PERSONNEL: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT – III: **10 Hours**

QUALITY CONTROL: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities.

UNIT – IV: **08 Hours**

COMPLAINTS: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT – V: **07 Hours**

CALIBRATION AND VALIDATION: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management.

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP607P	Medicinal Chemistry III Lab	L-T-P-C: 0-0-4-2

Course Outcome

Upon completion of this course, students will be able to:

CO1: Outline the principle and procedure for preparation, physicochemical characterization (including in silico) and estimation of organic drugs and their intermediates

CO2: Outline the principle and operations of various analytical tools and techniques in compound synthesis.

CO3: Synthesize and purify of medicinally important organic compounds.

CO4: Interpret the spectral characterizations made by IR and 1H-NMRs of synthesized compounds.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
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CO 3	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
CO 4	2	1	1	2	1	1	1	1	2	1	2	2	2	1	2
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**

PRACTICALS

1. **PREPARATION OF DRUGS AND INTERMEDIATES**

   Sulphanilamide, 7-Hydroxy, 4-methyl coumarin, Chlorobutanol, Triphenyl, imidazole, Tolbutamide, Hexamine

2. **ASSAY OF DRUGS**

   Isonicotinic acid hydrazide, Chloroquine, Metronidazole, Dapsone, Chlorpheniramine maleate, Benzyl penicillin, Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

3. **DRAWING STRUCTURES AND REACTIONS USING CHEM DRAW®**

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

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical / Non-University Exam**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

BP608P	Pharmacology III Lab	L-T-P-C: 0-0-4-2

Course Outcome

Upon completion of this course, students will be able to:

CO1: Explain the importance of isolated preparation, mechanism of drug action, agonist, antagonist on isolated tissues, expertise in performing bioassay of drugs.

CO2: Analyse the rational and irrational fixed dose combinations and pharmaceutical dosage calculations based on various parameters.

CO3: Interpret and calculate the pharmacokinetic parameters and determine the toxicity studies.

CO4: Explain and apply biostatistics in experimental pharmacology.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	2	1	2	1	2	2	2	1	1
CO 2	2	1	1	1	1	1	2	1	2	1	2	2	2	1	1
CO 3	2	1	1	1	1	1	2	1	2	1	2	2	2	1	1
CO 4	2	1	1	1	1	1	2	1	2	1	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine

8. Insulin hypoglycaemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata
9. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan
10. N. Udupa and P.D. Gupta, Concepts in Chrono pharmacology

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP609P	Herbal Drug Technology Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

CO1: Prepare, label, and evaluate herbal formulations.
CO2: Evaluate excipients, marketed cosmetic and nutraceutical formulations.
CO3: Explain preformulation parameters and understand underlying rationale.
CO4: Conduct in vitro assays for correlation with biological efficacy.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	3	1	1	1	1	2	2	2	2	3	2	-
CO 2	2	1	1	2	1	1	1	1	2	1	2	2	2	2	-
CO 3	2	1	1	1	1	1	1	1	2	2	2	1	3	2	-
CO 4	2	1	1	2	1	1	1	1	2	2	2	1	2	2	-
Average	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**-**

PRACTICALS

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H. Ansari
5. Pharmacognosy & Phytochemistry by V.D. Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	Criteria	Marks
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

SEMESTER VII

BP701T	Instrumental Methods of Analysis	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
- Understand the chromatographic separation and analysis of drugs.
- Perform quantitative & qualitative analysis of drugs using various analytical instruments.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Perform and analyze qualitative and quantitative analysis of drugs by using various analytical techniques

CO2: Explain the basic principle behind the interaction of electromagnetic radiations with matter in drug analysis and applications of electromagnetic radiations.

CO3: Student will be able to demonstrate various chromatographic separation techniques used in analysis of drug products.

CO4: Depict the various spectroscopic assay methods and their applications as per ICH guidelines.

CO5: Analyze the various spectrums including IR, UV and HPLC spectra

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	1	1	1	1	2	2	2	2	2	1	2
CO 2	2	1	2	3	1	1	1	1	2	2	2	2	2	1	2
CO 3	2	1	2	3	1	1	1	1	2	2	2	2	2	1	2
CO 4	2	1	2	3	1	1	1	1	2	2	2	2	2	1	2
CO 5	2	1	2	3	1	1	1	1	2	2	2	2	2	1	2
Average	**2**	**1**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT – I: UV VISIBLE SPECTROSCOPY **10 Hours**

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors-Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

FLUORIMETRY

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT –II: IR SPECTROSCOPY **10 Hours**

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III: INTRODUCTION TO CHROMATOGRAPHY **10 HOURS**

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

UNIT –IV: GAS CHROMATOGRAPHY - **08 HOURS**

Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT –V: ION EXCHANGE CHROMATOGRAPHY- 07 HOURS

Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

Reference and Textbooks:-

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors 4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
4. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
5. Organic Chemistry by I. L. Finar
6. Organic spectroscopy by William Kemp
7. Quantitative Analysis of Drugs by D. C. Garrett
8. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
9. Spectrophotometric identification of Organic Compounds by Silverstein.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1

80 – 84	1	0.5
Less than 80	0	0

BP702T	Industrial Pharmacy II	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know the process of pilot plant and scale up of pharmaceutical dosage forms
- Understand the process of technology transfer from lab scale to commercial batch
- Know different Laws and Acts that regulate pharmaceutical industry
- Understand the approval process and regulatory requirements for drug products

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Student will be able to explain the various techniques of pilot plant and scale up of pharmaceutical dosage forms.

CO2: Student will be able to elaborate the guidelines and related documentation of technology transfer and development.

CO3: Student will be able to explain and understand the different laws and acts required to regulate the pharmaceutical industry.

CO4: Student will be able to understand the concept of quality management systems and series of quality system standards.

CO5: Students will be able to identify the role and requirements of Indian Regulatory Standards.

Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	2	1	2	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	2	1	2	1	2	2	2	1	2
CO 3	2	1	1	1	1	1	2	1	2	1	2	2	2	1	2
CO 4	2	1	1	1	1	1	2	1	2	1	2	2	2	1	2
CO 5	2	1	1	1	1	1	2	1	2	1	2	2	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT-I: PILOT PLANT SCALE UP TECHNIQUES **10 Hours**

General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology.

UNIT-II: TECHNOLOGY DEVELOPMENT AND TRANSFER **10 Hours**

WHO guidelines for Technology Transfer (TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R, D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipment, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues.

UNIT-III: REGULATORY AFFAIRS **10 Hours**

Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT-IV: QUALITY MANAGEMENT SYSTEMS **08 Hours**

Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP.

UNIT-V: INDIAN REGULATORY REQUIREMENTS **07 Hours**

Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

References:

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP703T	Pharmacy Practice	L-T-P-C: 3-1-0-4

COURSE OBJECTIVE

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

1. Know various drug distribution methods in a hospital
2. Monitor drug therapy of patient through medication chart review and clinical review
3. Obtain medication history interview and counsel the patients, identify drug related problems, detect and assess adverse drug reactions
4. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
5. Know pharmaceutical care services, do patient counseling in community pharmacy, appreciate the concept of Rational drug therapy.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Define and classify the types of hospitals and their organization.
CO2: Illustrate the various drug distribution system and methods in a hospital.
CO3: Explain the role of Pharmacy and Therapeutic Committee and Drug Information Centre.
CO4: Appreciate and apply the knowledge in drug store management and inventory control.
CO5: Analyze and investigate the various laboratory diagnostic tests and the rational use of medicines.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by 1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	1	1	1	-	-	-	-	-	-	-	-
CO 4	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
CO 5	2	2	-	-	1	1	1	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	-	**1**	**1**	**1**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

Unit I: HOSPITAL AND IT'S ORGANIZATION **10 hours**

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

HOSPITAL PHARMACY AND ITS ORGANIZATION

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

ADVERSE DRUG REACTION

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

COMMUNITY PHARMACY

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

UNIT II: DRUG DISTRIBUTION SYSTEM IN A HOSPITAL **10 Hours**

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

HOSPITAL FORMULARY

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

THERAPEUTIC DRUG MONITORING

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

MEDICATION ADHERENCE

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

PATIENT MEDICATION HISTORY INTERVIEW

Need for the patient medication history interview, medication interview forms.

COMMUNITY PHARMACY MANAGEMENT

Financial, materials, staff, and infrastructure requirements.

UNIT III: PHARMACY AND THERAPEUTIC COMMITTE 10 Hours

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

DRUG INFORMATION SERVICES

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

PATIENT COUNSELING

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

EDUCATION AND TRAINING PROGRAM IN THE HOSPITAL

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

PRESCRIBED MEDICATION ORDER AND COMMUNICATION SKILLS

Prescribed medication order- interpretation and legal requirements, and Communication skills-communication with prescribers and patients.

UNIT IV: BUDGET PREPARATION AND IMPLEMENTATION 08 Hours

Budget preparation and implementation

CLINICAL PHARMACY

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

OVER THE COUNTER (OTC) SALES

Introduction and sale of over the counter, and Rational use of common over the counter medications.

UNIT V: DRUG STORE MANAGEMENT AND INVENTORY CONTROL 07 Hours

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

INVESTIGATIONAL USE OF DRUGS

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

INTERPRETATION OF CLINICAL LABORATORY

Tests Blood chemistry, hematology, and urinalysis.

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. Basic skills in interpreting laboratory data, 4thed. American Society of Health System Pharmacists Inc; 2009.
6. Parmar N.S. Health Education and Community Pharmacy, 18th ed. India: CBS Publishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine).

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	Criteria	Marks
1	Attendance	4

2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP704T	Novel Drug Delivery System	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe and define the novel drug delivery systems

CO2: Identify the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

CO3: Design the novel drug formulations based on various approaches.

CO4: Describe the formulation, merits, demerits, applications and evaluation of Novel Drug Delivery Systems.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	-	-	1	1	2	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	1	1	2	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	1	1	2	-	-	-	-	-	-	-	-
CO 4	2	2	-	-	1	1	2	-	2	1	2	1	2	1	1
CO 5	2	2	-	-	1	1	2	-	2	1	2	1	2	1	1
Average	**2**	**2**	-	-	**1**	**1**	**2**	-	**2**	**1**	**2**	**1**	**2**	**1**	**1**

Syllabus

Unit-I: CONTROLLED DRUG DELIVERY SYSTEMS: 10 Hours

Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design-controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations.

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

UNIT-II: MICROENCAPSULATION: 10 Hours

Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications.

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems.

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implantsand osmotic pump.

UNIT-III: TRANSDERMAL DRUG DELIVERY SYSTEMS: 10 Hours

Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches.

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high-density systems, inflatable and gastroadhesive systems and their applications.

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers.

UNIT-IV: TARGETED DRUG DELIVERY: 08 HOURS

Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications.

UNIT-V: OCULAR DRUG DELIVERY SYSTEMS: 07 HOURS

Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts.

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications.

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP705P	Instrumental Methods of Analysis Lab	L-T-P-C: 0-0-4-2

COURSE OUTCOME

Upon completion of this course, students will be able to:

CO1: Perform the isolation of amino acids, sugars and plant pigments by analytical tools.
CO2: Describe and perform the qualitative and quantitative analysis of compounds.
CO3: Analyze the various analytical tool in the determination of organic compounds**.**
CO4: Demonstrate the experiments on HPLC and Gas Chromatography.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	2	1	1	1	1	-	1	2	2	2	1	1
CO 2	2	1	-	-	1	1	1	1	2	1	2	2	2	1	1
CO 3	2	1	-	-	1	1	1	1	-	1	2	2	2	1	1
CO 4	2	1	2	2	1	1	1	1	2	1	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

PRACTICALS

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5. Assay of paracetamol by UV- Spectrophotometry
6. Estimation of quinine sulfate by fluorimetry
7. Study of quenching of fluorescence
8. Determination of sodium by flame photometry

9. Determination of potassium by flame photometry
10. Determination of chlorides and sulphates by nephelo turbidometry
11. Separation of amino acids by paper chromatography
12. Separation of sugars by thin layer chromatography
13. Separation of plant pigments by column chromatography
14. Demonstration experiment on HPLC
15. Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. 3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 50 (Practical Exam)
Two Sessional Practical Examination (10) + Continuous Mode (05) = 15 marks
End Semester Practical Examination = 35 marks

For Continuous mode Practical

S. No.	**Criteria**	**Marks**
1	Attendance	2
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	1.5
3	Student – Teacher interaction	1.5
Total		05

Guidelines for the allotment of marks for attendance

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

BP706PS	Practice School	L-T-P-C: 0-0-12-6

COURSE OUTCOME:

Upon completion of this course, students will be able to:

CO1: Understand the basic medical and pharmaceutical sciences in order to prepare a dosage regimen for an individual patient.

CO2: Enhance patient safety to safe medication usage in community and health care systems

CO3: Perform better pharmacy practice in the areas including clinical pharmacy, community pharmacy, hospital pharmacy and industrial pharmacy**.**

CO4: Cater the needs of national and international health organizations or authorities to help adapt the paradigm shift in the health care system.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	1	2	3	1	1	1	1	2	2	3		1
CO 2	2	1	1	1	2	3	1	-	-	1	2	3		3	1
CO 3	2	1	1	1	2	3	1	2	2	1	2		3	2	1
CO 4	2	1	1	1	2	3	1	1	1	1	2	3	2	3	1
Average	**2**	**1**	**1**	**1**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**

Syllabus

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time. At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level and grade point shall be awarded.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 150 (Practical Exam)
Internal assessment = 25 marks
End Semester Practical Examination = 125 marks

BP801T	Biostatistics and Research Methodology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know the operation of M.S. Excel, SPSS, R and MINITAB® , DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Demonstrate an understanding of basic concepts of modern statistical theory and techniques.
CO2: Apply the various biostatistical tool in pharmacy.
CO3: Classify the statistical techniques, design of experiments and use of software in analysing the statistical data.
CO4: Explain the need for design of experiments and various methodologies used in designing the research study.
CO5: Describe the Practical components of Industrial and Clinical Trials Problems.

Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 3	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 4	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 5	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
Average	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT-I: **10 Hours**

INTRODUCTION:

Statistics, Biostatistics, Frequency distribution.

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples.

Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems.

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples.

UNIT-II: **10 Hours**

REGRESSION:

Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples.

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test (Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference.

Unit-III: **10 Hours**

NON-PARAMETRIC TESTS:

Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

UNIT-IV: **8 Hours**

BLOCKING AND CONFOUNDING SYSTEM FOR TWO-LEVEL FACTORIALS

Regression modeling: Hypothesis testing in Simple and Multiple regression models

Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach.

UNIT-V: **7 Hours**

DESIGN AND ANALYSIS OF EXPERIMENTS:

Factorial Design: Definition, 2^2, 2^3 design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

References and Textbooks:

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g., quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP802T	Social and Preventive Pharmacy	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related to health and pharmaceutical issues

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Demonstrate and evaluate the current health issues, challenges and pharmaceutical problems within the country and worldwide.
CO2: Apply the critical thinking approach on development of current health care and hygiene.
CO3: Describe the general principle of prevention and control of communicable diseases.
CO4: Explain the need of National Health Programs, its objective, functioning and outcome.
CO5: Assess the role of community services and PHC in rural, urban and school health.

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	2	2	1	2	3	2	2	2	3	3	1
CO 2	2	1	1	1	2	2	1	2	3	2	2	3	-	3	1
CO 3	2	1	1	1	2	2	1	2	3	2	2	-	2	-	1
CO 4	2	1	1	1	2	2	1	2	3	2	2	2	3	2	1
CO 5	2	1	1	1	2	2	1	2	3	2	2	3	2	2	1
Average	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**

Syllabus

Unit I: Concept of health and disease: **10 Hours**

Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

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

Hygiene and health: personal hygiene and health care; avoidable habits

UNIT II: PREVENTIVE MEDICINE: 10 Hours

General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse.

UNIT III: NATIONAL HEALTH PROGRAMS, ITS OBJECTIVES, FUNCTIONING AND OUTCOME OF THE FOLLOWING: 10 Hours

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

UNIT IV: 08 Hours

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, social health programme; role of WHO in Indian national program.

UNIT V: 07 Hours

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy
3. Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
4. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications

5. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D,
6. Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
7. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
8. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

Research in Social and Administrative Pharmacy, Elsevier, Ireland.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 100
Two Sessional Examination (15) + Continuous Mode (10) = 25 marks
End Semester Examination = 75 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	4
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3
3	Student – Teacher interaction	3
Total		10

Guidelines for the allotment of marks for attendance

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

BP803ET	Pharma Marketing Management	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Describe the basic concepts of sale and marketing of Pharmaceutical Products.
CO2: Analyze qualitative and quantitative aspects of pharmaceutical market.
CO3: Define and classify the product line, product mix decision and management in pharmaceutical industry.
CO4: Assess the personal selling, advertising, sampling, and online promotional techniques for OTC Products.
CO5: Explain and design various pharmaceutical marketing channels and determining the pricing methods and strategies.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Syllabus

Unit I: MARKETING: **10 hours**

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

PHARMACEUTICAL MARKET:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

UNIT II: PRODUCT DECISION: **10 Hours**

Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

UNIT III: PROMOTION: **10 Hours**

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

UNIT IV: PHARMACEUTICAL MARKETING CHANNELS: **10 Hours**

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

PROFESSIONAL SALES REPRESENTATIVE (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

UNIT V: PRICING: **10 Hours**

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

EMERGING CONCEPTS IN MARKETING:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	8
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	6
3	Student – Teacher interaction	6
Total		20

BP804ET	Pharmaceutical Regulatory Science	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know about the process of drug discovery and development
- Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- Know the regulatory approval process and their registration in Indian and international markets

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the fundamental knowledge on regulatory requirements for new drugs and drug products in the regulated market of India and other countries.

CO2: Describe the various steps involved in drug discovery and development process.

CO3: Discuss the role of regulatory authorities and agencies in governing the registration of drug products in India and international market.

CO4: Explain the regulatory approval process for manufacturing and sale of pharmaceuticals.

CO5: Describe the managing and monitoring of clinical trial and safety monitoring of clinical trials *i.e*. pharmacovigilance.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Syllabus

Unit I: NEW DRUG DISCOVERY AND DEVELOPMENT **10 Hours**

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT II: REGULATORY APPROVAL PROCESS **10 Hours**

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

REGULATORY AUTHORITIES AND AGENCIES

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

UNIT III: REGISTRATION OF INDIAN DRUG PRODUCT IN OVERSEAS MARKET

10 Hours

Procedure for export of pharmaceutical products, technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

UNIT IV: CLINICAL TRIALS **08 Hours**

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.

UNIT V: REGULATORY CONCEPTS **07 Hours**

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.

3. New Drug Approval Process: Accelerating Global Registrations by Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance by Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, 2017. Fourth Edition. John I. Gallin and Frederick P. Ognibene John Gallin, Frederick Ognibene, Laura Lee Johnson (Eds.)
9. Drugs: From Discovery to Approval, Second Edition by Rick Ng. Third edition. ISBN: 978-1-118-90727-6. June 2015. Wiley-Blackwell.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150 marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	8
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	6
3	Student – Teacher interaction	6
Total		20

BP805ET	Pharmacovigilance	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
12. CIOMS requirements for ADR reporting
13. Writing case narratives of adverse events and their quality.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the Drug Safety Monitoring, history and development of pharmacovigilance.
CO2: Detect, assess and monitor the adverse drug reaction and CIOMS requirements.
CO3: Explain the International standards for classification of diseases and drugs.
CO4: Depict the methods to generate the safety data during pre-clinical, clinical and post approval phases of drugs' life cycle.
CO5: Describe the guidelines for ADR reporting and pharmacovigilance planning.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	2	1	2	1	2	2	1	2	2
CO 2	2	1	1	1	1	1	2	1	2	1	2	2	1	2	2
CO 3	2	1	1	1	1	1	2	1	2	1	2	2	1	2	2
CO 4	2	1	1	1	1	1	2	1	2	1	2	2	1	2	2
CO 5	2	1	1	1	1	1	2	1	2	1	2	2	1	2	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**2**

Syllabus

Unit I INTRODUCTION TO PHARMACOVIGILANCE **10 Hours**

History and development of Pharmacovigilance, Importance of safety monitoring of Medicine, WHO international drug monitoring programme, Pharmacovigilance Program of India (PvPI)

INTRODUCTION TO ADVERSE DRUG REACTIONS

Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions

BASIC TERMINOLOGIES USED IN PHARMACOVIGILANCE

Terminologies of adverse medication related events, Regulatory terminologies.

UNIT II DRUG AND DISEASE CLASSIFICATION **10 Hours**

Anatomical, therapeutic and chemical classification of drugs, International classification of diseases, Daily defined doses, International Nonproprietary Names for drugs

DRUG DICTIONARIES AND CODING IN PHARMACOVIGILANCE

WHO adverse reaction terminologies, MedDRA and Standardized MedDRA queries, WHO drug dictionary, Eudravigilance medicinal product dictionary

INFORMATION RESOURCES IN PHARMACOVIGILANCE

Basic drug information resources, Specialized resources for ADRs

ESTABLISHING PHARMACOVIGILANCE PROGRAMME

Establishing in a hospital, Establishment & operation of drug safety department in industry, Contract Research Organizations (CROs), Establishing a national programme.

UNIT III VACCINE SAFETY SURVEILLANCE **10 Hours**

Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization

PHARMACOVIGILANCE METHODS

Passive surveillance – Spontaneous reports and case series, Stimulated reporting, Active surveillance – Sentinel sites, drug event monitoring and registries, Comparative observational studies – Cross sectional study, case control study and cohort study, Targeted clinical investigations

COMMUNICATION IN PHARMACOVIGILANCE

Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

UNIT IV SAFETY DATA GENERATION **08 Hours**

Pre-clinical phase, Clinical phase, Post approval phase (PMS)

ICH GUIDELINES FOR PHARMACOVIGILANCE

Organization and objectives of ICH, expedited reporting, Individual case safety reports, Periodic safety update reports, Post approval expedited reporting, Pharmacovigilance planning, Good clinical practice in pharmacovigilance studies.

UNIT V: PHARMACOGENOMICS OF ADVERSE DRUG REACTIONS **07 Hours**

Genetics related ADR with example focusing PK parameters.

DRUG SAFETY EVALUATION IN SPECIAL POPULATION

Pediatrics, Pregnancy and lactation, Geriatrics

CIOMS

CIOMS Working Groups, CIOMS Form

CDSCO (INDIA) AND PHARMACOVIGILANCE

D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.

2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller, Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy, Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills: G. Parthasarathi, Karin NyfortHansen, Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	8
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	6
3	Student – Teacher interaction	6
Total		20

BP806ET	Quality Control and Standardization of Herbals	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Know WHO guidelines for quality control of herbal drugs
- Know Quality assurance in herbal drug industry
- Know the regulatory approval process and their registration in Indian and international markets
- Appreciate EU and ICH guidelines for quality control of herbal drugs

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Analyze the pharmaceutical substances and understand WHO guidelines for quality control of pharmaceuticals and herbal drugs.
CO2: Explain the quality assurance of herbal drugs as well as their evaluation.
CO3: Describe the regulatory approval procedures and registration of drugs in Indian as well as international markets.
CO4: Appreciate the research guidelines for evaluation of safety and efficacy of herbal medicines.
CO5: Explain the good manufacturing practices as well as good laboratory practices in traditional system of medicines.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	2	1	1	2	2	2	2	1	2
CO 2	2	1	1	1	1	1	2	1	1	2	2	2	2	1	2
CO 3	2	1	1	1	1	1	2	1	1	2	2	2	2	1	2
CO 4	2	1	1	1	1	1	2	1	1	2	2	2	2	1	2
CO 5	2	1	1	1	1	1	2	1	1	2	2	2	2	1	2

Average	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**

Syllabus

Unit I **10 Hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms, WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use.

UNIT II **10 Hours**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.

UNIT III **10 Hours**

EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines.

UNIT IV **08 Hours**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

UNIT V **07 Hours**

Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,

6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

For Continuous mode Theory

S. No.	**Criteria**	**Marks**
1	Attendance	8
2	Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	6
3	Student – Teacher interaction	6
Total		20

BP807ET	Computer Aided Drug Design	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modelling software

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the stages of drug discovery and development.
CO2: Apply the knowledge of drug designing in the development of lead molecule.
CO3: Explain the concept of QSAR and molecular docking.
CO4: Develop strategy to develop a new drug molecule.
CO5: Design new drug molecules using molecular modelling software.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	-	1		2		2	2	2	1	1	1	3	2	2
CO 2	2	-	2	3	1	2	-	-	1	-	3	2	1	-	-
CO 3	1	2	2	1	-	-	-	-	-	1	1	2	-	1	-
CO 4	2	2	2	1	2	3	2	2	2	1	3	2	1	3	1
CO 5	1	1	1	2	-	2	-	1	-	-	2	1	-	-	-
Average	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

Syllabus

UNIT-I: INTRODUCTION TO DRUG DISCOVERY AND DEVELOPMENT 10 Hours

Stages of drug discovery and development

LEAD DISCOVERY AND ANALOG BASED DRUG DESIGN

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bio-isosterism, Classification, Bio-isosteric replacement. Any three case studies

UNIT-II: QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIP (QSAR) 10 Hours

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III: MOLECULAR MODELING AND VIRTUAL SCREENING TECHNIQUES 10 HOURS

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design.

UNIT-IV: INFORMATICS & METHODS IN DRUG DESIGN 08 HOURS

Introduction to Bioinformatics, cheminformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT-V: MOLECULAR MODELING: 07 HOURS

Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Park Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.

3. Delgado JN, Remers WA eds “Wilson & Gisvolds’s Text Book of Organic Medicinal & Pharmaceutical Chemistry” Lippincott, New York.
4. Foye WO “Principles of Medicinal chemistry ‘Lea & Febiger.
5. Koro lkovas A, Burckhalter JH. “Essentials of Medicinal Chemistry” Wiley Interscience.
6. Wolf ME, ed “The Basis of Medicinal Chemistry, Burger’s Medicinal Chemistry” John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, “Introduction to the principles of Drug Design” Wright Boston.
9. Silverman R.B. “The organic Chemistry of Drug Design and Drug Action” Academic Press New York.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP808ET	Cell and Molecular Biology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

1. Summarize cell and molecular biology history.
2. Summarize cellular functioning and composition.
3. Describe the chemical foundations of cell biology.
4. Summarize the DNA properties of cell biology.
5. Describe protein structure and function.
6. Describe cellular membrane structure and function.
7. Describe basic molecular genetic mechanisms.
8. Summarize the Cell Cycle

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain and summarize the history, functioning and composition of cellular and molecular biology.
CO2: Describe the chemical foundations of cell biology and cell membrane structure and function.
CO3: Explain basic mechanism of molecular genetics.
CO4: Identify and understand the structure properties and functions of DNA and proteins.
CO5: Explain cell cycle.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 3	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 4	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
CO 5	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

Unit I **10 Hours**

Cell and Molecular Biology: Definitions theory and basics and Applications. Cell and Molecular Biology: History and Summation. Properties of cells and cell membrane. Prokaryotic versus Eukaryotic Cellular Reproduction Chemical Foundations – an Introduction and Reactions (Types).

UNIT II **10 Hours**

DNA and the Flow of Molecular Information, DNA Functioning, DNA and RNA, Types of RNA, Transcription and Translation.

UNIT III **10 Hours**

Proteins: Defined and Amino Acids, Protein Structure, Regularities in Protein Pathways, Cellular Processes, Positive Control and significance of Protein Synthesis.

UNIT IV **08 Hours**

Science of Genetics, Transgenics and Genomic Analysis, Cell Cycle analysis, Mitosis and Meiosis, Cellular Activities and Checkpoints.

UNIT V **07 Hours**

Cell Signals: Introduction, Receptors for Cell Signals, Signaling Pathways: Overview, Misregulation of Signaling Pathways, Protein-Kinases: Functioning.

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and
13. Applications of RecombinantDNA: ASM Press Washington D.C.
14. RA Goldshy et. al., Kuby Immunology.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP809ET	Cosmetic Science	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Classify cosmetics and cosmeceutical products.
- Understand the evolution of cosmeceutical products.
- Understand the principle formulation and building blocks of cosmetic products.
- Explain the role of herbs in cosmetics.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Formulate and classify cosmetics and cosmeceutical products.
CO2: Describe the evolution of cosmeceutical products and use of excipients.
CO3: Explain the principle formulation and building blocks of cosmetic products.
CO4: Identify and apply the role of herbs in cosmetics.
CO5: Evaluate the various cosmetic products.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
CO 3	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
CO 4	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
CO 5	2	1	1	1	1	1	1	1	2	1	2	2	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**

Syllabus

UNIT I **10 Hours**

Classification of cosmetic and cosmeceutical products, Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums.

UNIT II: PRINCIPLES OF FORMULATION AND BUILDING BLOCKS OF SKIN CARE PRODUCTS

10 Hours

Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

PRINCIPLES OF FORMULATION AND BUILDING BLOCKS OF HAIR CARE PRODUCTS:

Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine-based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

ROLE OF HERBS IN COSMETICS:

Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste.

UNIT IV **08 Hours**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties, Soaps, and syndet bars. Evolution and skin benefits.

UNIT V **07 Hours**

Oily and dry skin, causes leading to dry skin, skin moisturization. Basic understanding of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall

causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

References

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3. Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publisher

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP810ET	Experimental Pharmacology	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research.
- Appreciate and demonstrate the importance of biostatistics and research methodology.
- Design and execute a research hypothesis independently.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Explain the use of common laboratory animals, their handling.

CO2: Demonstrate the various screening methods used in preclinical studies.

CO3: Apply biostatistics and research methodology in preclinical studies**.**

CO4: Design and execute a research hypothesis independently.

CO5: Explain the regulatory guidelines related to animal studies.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	1	1	1	1	1	2	2	2	2	2	1	2
CO 2	2	1	1	1	1	1	1	1	2	2	2	2	2	1	2
CO 3	2	1	1	1	1	1	1	1	2	2	2	2	2	1	2
CO 4	2	1	1	1	1	1	1	1	2	2	2	2	2	1	2
CO 5	2	1	1	1	1	1	1	1	2	2	2	2	2	1	2
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**

Syllabus

Unit –I: LABORATORY ANIMALS: 08 Hours

Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals.

Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

UNIT –II: PRECLINICAL SCREENING MODELS 10 Hours

Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.

STUDY OF SCREENING ANIMAL MODELS FOR

Diuretics, nootropics, anti-Parkinson's, antiasthmatics,

Preclinical screening models: for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, Alzheimer's disease

UNIT –III: PRECLINICAL SCREENING MODELS: 05 Hours

For ANS activity, sympathomimetics, sympatholytic, parasympathomimetic, parasympatholytic, skeletal, muscle relaxants, drugs acting on eye, local anesthetics

UNIT –IV: PRECLINICAL SCREENING MODELS: 05 Hours

For CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti-aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

UNIT V: RESEARCH METHODOLOGY AND BIO-STATISTICS 05 Hours

Selection of research topic review of literature, research hypothesis and study design pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N. Ghosh
2. Hand book of Experimental Pharmacology-S.K. Kulkarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP811ET	Advanced Instrumentation Techniques	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the advanced instruments used and its applications in drug analysis
- Understand the calibration of various analytical instruments
- Know analysis of drugs using various analytical instruments.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Analyze different instrumental methods in qualitative and quantitative analysis of drugs.

CO2: Understand various validation parameters according to ICH guidelines and apply them in their research

CO3: Derive concepts, equations and solve problems related to analysis of drugs using instrumental methods.

CO4: Examine the operational errors of the instruments and methods for its removal

CO5: Interpret NMR, Mass, DSC, XRD spectra and extract important information from the spectra

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1
CO 2	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1
CO 3	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1
CO 4	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1
Average	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT-I: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY **10 Hours**

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers - Time of flight and Quadrupole, instrumentation, applications.

UNIT-II: THERMAL METHODS OF ANALYSIS: **10 Hours**

Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X- ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT-III: CALIBRATION AND VALIDATION- **10 Hours**

as per ICH and USFDA guidelines Calibration of following Instruments Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC.

UNIT-IV: RADIO IMMUNE ASSAY: **08 Hours**

Importance, various components, Principle, different methods, Limitation and Applications of Radio immune assay

Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction.

UNIT-V: HYPHENATED TECHNIQUES- **07 Hours**

LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel

5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP812ET	Dietary Supplements and Nutraceuticals	L-T-P-C: 3-1-0-4

COURSE OBJECTIVES

- Understand the need of supplements by the different group of People to maintain healthy life.
- Understand the outcome of deficiencies in dietary supplements.
- Appreciate the components in dietary supplements and the application.
- Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO1: Classify nutraceuticals and dietary supplements in health and disease.
CO2: Explain phytochemicals as nutraceuticals, their occurrence and characteristics.
CO3: Describe the mechanism of free radicals in various diseases.
CO4: Appreciate the components in dietary supplements and the application.
CO5: Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 2	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 3	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 4	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
CO 5	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1
Average	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Syllabus

UNIT I **07 Hours**

Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e., weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds.

UNIT II **15 Hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following:

Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin

Sulfides: Diallyl sulfides, Allyl trisulfide.

Polyphenolics: Reservetrol

Flavonoids- Rutin, Naringin, Quercitin, Anthocyanidins, catechins, Flavones

Prebiotics / Probiotics: Fructo oligosaccharides, Lactobacillum

Phyto estrogens: Isoflavones, daidzein, Geebustin, lignans Tocopherols

Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III **07 Hours**

Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids. Dietary fibers and complex carbohydrates as functional food ingredients.

UNIT IV **10 Hours**

Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic

acid, melatonin. Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. Functional foods for chronic disease prevention.

UNIT V **06 Hours**

Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. Pharmacopeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi.
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BS Publication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors 2000 Functional foods Woodhead Publ.Co.London.
7. Goldberg, I. Functional Foods. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in Essentials of Functional Foods M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 Modern Nutrition in Health and Disease. Eighth edition. Lea and Febiger.

Mode of Evaluation: As per PCI regulations (UG)

B. Pharm Total Marks = 200
Two Sessional Examination (30) + Continuous Mode (20) = 50marks
End Semester Examination = 150marks

BP813PW	**Project Work**	**L-T-P-C: 0-0-12-6**

COURSE DESCRIPTION

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subject opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students). The projects shall be evaluated as per the criteria given below.

Course Outcome

Upon completion of this course, students will be able to:

CO1: Identify the problem and generate the topic and objectives for the research work.
CO2: Integrate the information related to the topic.
CO3: Design the methodologies and plan of work related to the research.
CO4: Assemble the contents of the research into a more realistic draft ethically and conclude the contents.
CO5: Explain research work with the help of presentation

Co-Relationship Matrix

Relationship between the Course Outcome (COs), Program Outcome (POs) and Program Educational Objectives (PSOs)

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	1	2	1	1	2	1	2	1	1	2	2	1	1	1
CO 2	1	1	2	1	1	2	1	2	1	1	2	2	1	1	1
CO 3	1	1	2	1	1	2	1	2	1	1	2	2	1	1	1
CO 4	1	1	2	1	1	2	1	2	1	1	2	2	1	1	1
CO 5	1	1	2	1	1	2	1	2	1	1	2	2	1	1	1
Average	**1**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

Evaluation of Dissertation Book:

Objective(s) of the work done	15 Marks
Methodology adopted	20 Marks
Results and Discussions	20 Marks
Conclusions and Outcomes	20 Marks
Total	**75 Marks**

Evaluation of Presentation:

Presentation of work	25 Marks
Communication skills	20 Marks
Question and answer skills	30 Marks
Total	**75 Marks**

Explanation: The 75 marks assigned to the dissertation book shall be same for all the students in a group. However, the 75 marks assigned for presentation shall be awarded based on the performance of individual students in the given criteria.