Pt. Ravishankar Shukla University,
Raipur (C.G.), India 492010

CURRICULUM & Syllabus
(Based on CBCS & LOCF)

M. Pharm.- Pharmacology
(Semester System)

Semester: I-IV

Session: 2025-2026

टीपः– सत्र. 2024.2025 के पाठ्यक्रम को सत्र 2025.2026.....के लिए यथावत प्रभावशील किया जाता है।

Approved by	:	
Board of Studies	:	Pharmacy
Dates	:	16-05-2025
Name of Chairman	:	Dr. S. J. Daharwal
Name of Member's	:	Dr. Preeti K. Suresh
		Dr. Manju Singh
		Dr. Amber Vyas
		Dr. Deependra Singh

M. Pharm in Pharmacology

Program Outcomes (POs)

PO-1: Knowledge
Gain in-depth knowledge of drug actions, pharmacokinetics, pharmacodynamics, toxicology, preclinical and clinical evaluations, and molecular mechanisms relevant to human health and diseases.

PO-2: Critical Thinking and Reasoning
Develop the ability to critically analyze pharmacological data, interpret experimental results, and evaluate the efficacy and safety of drugs through evidence-based approaches.

PO-3: Problem Solving
Identify and solve problems related to adverse drug reactions, drug interactions, and therapeutic failures using pharmacological and toxicological assessments.

PO-4: Advanced Analytical and Computational Skills
Utilize modern experimental pharmacology tools, in vivo and in vitro models, and computational simulations to investigate drug effects and mechanisms.

PO-5: Effective Communication
Communicate pharmacological findings clearly and effectively in research, academic, clinical, and regulatory settings, both orally and in writing.

PO-6: Social/Interdisciplinary Interaction
Collaborate with interdisciplinary teams in areas such as clinical pharmacy, toxicology, biochemistry, and molecular biology to advance therapeutic solutions and drug safety assessments.

PO-7: Self-directed and Life-long Learning
Demonstrate independent learning and a commitment to continuous professional development by staying updated with new drug discoveries, regulatory updates, and advanced pharmacological research.

PO-8: Effective Citizenship: Leadership and Innovation
Contribute to pharmacovigilance, public health policy, and innovation in drug development, acting as ethical leaders and responsible professionals in both industry and academia.

PO-9: Ethics
Uphold high ethical standards in conducting animal and human research, ensuring compliance with institutional and national ethical guidelines and practicing humane care.

PO-10: Further Education or Employment
Pursue advanced research (Ph.D.), careers in R&D, clinical research, regulatory affairs, drug safety, medical writing, or academic positions in the field of pharmacology.

PO-11: Global Perspective
Understand and evaluate global trends in drug development, regulatory affairs, and translational pharmacology with an appreciation of cultural and healthcare diversity.

Program Specific Outcomes (PSOs)

PSO-1: Experimental Pharmacology Proficiency
Demonstrate expertise in designing and conducting preclinical studies using animal models and alternative methods to evaluate pharmacological activity and toxicity.

PSO-2: Clinical and Regulatory Acumen
Interpret clinical trial data, understand ethical and regulatory requirements for human research, and contribute to the development of safe and effective therapeutic protocols.

PSO-3: Drug Discovery and Mechanistic Research
Contribute to the identification of novel drug targets and elucidation of mechanisms of action using molecular, cellular, and systems-level pharmacology tools.

PSO-4: Pharmacovigilance and Toxicological Evaluation
Apply principles of pharmacovigilance, adverse drug reaction monitoring, and safety pharmacology to ensure public safety and regulatory compliance.

PSO-5: Industry and Healthcare Readiness
Possess the skills necessary to work effectively in pharmaceutical industries, CROs, regulatory bodies, hospitals, or academic research with an understanding of Pharmacoeconomics and rational drug use.

M. Pharm. Pharmacology
Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	I
Course Code	Course Title		Course Type
MPL 101T	MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPL 101T)		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	--	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

After completion of course student is able to know about,

- Chemicals and Excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of pharmacognosy in the herbal drug industry and explain the principles and practices of cultivation, collection, and conservation of medicinal plants, including regulatory and ethical guidelines.	Ap
2	Describe the techniques for isolation and purification of marine natural products, identify marine toxins, discuss recent advances, and analyze challenges and solutions in marine drug research.	Ap
3	Explain the classification, formulation, standardization, and regulatory guidelines of nutraceuticals; and evaluate the sources, chemical nature, and health benefits of commonly used nutraceutical ingredients.	U
4	Identify and classify important phytopharmaceuticals based on chemical nature, explain their isolation, and evaluate their pharmacological and health-related applications.	An
5	Understand and apply WHO and AYUSH guidelines for safety monitoring of natural medicines, and analyze biodrug interactions and reporting systems with appropriate examples.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	3	1	2	3	3	2	3	2	2	3	1	2	3	2
CO2	3	3	3	3	1	1	3	1	2	3	2	2	3	2	1	2
CO3	3	3	2	3	2	2	2	2	2	3	3	3	3	2	2	3
CO4	3	2	3	3	2	1	3	2	2	3	2	3	3	3	2	2
CO5	3	3	2	1	3	2	3	1	3	2	3	2	2	2	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	a) **UV-Visible spectroscopy:** Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b) **IR spectroscopy:** Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy. c) **Spectroflourimetry:** Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d) Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	10hrs	1
II	**NMR spectroscopy**: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy.	10hrs	2
III	**Mass Spectroscopy**: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	10hrs	3
IV	**Chromatography**: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a. Thin Layer chromatography b. Thin Layer Chromatography c. Ion exchange chromatography d. Column chromatography e. Gas chromatography f. High Performance Liquid chromatography g. Affinity chromatography	10hrs	4
V	a. **Electrophoresis**: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing	10hrs	

	b. **X ray Crystallography**: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction **Immunological assays :** RIA (Radio immuno assay), ELISA,Bioluminescence assays		
VI	**Potentiometry:** Principle, working, Ion selective Electrodes and Application of potentiometry. **Thermal Techniques**: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.	10hrs	

Books Recommended:

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	I
Course Code	Course Title		Course Type
MPL 102T	ADVANCED PHARMACOLOGY - I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	--	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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

- Discuss the pathophysiology and pharmacotherapy of certain diseases
- Explain the mechanism of drug actions at cellular and molecular level
- Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the fundamental concepts of pharmacokinetics and pharmacodynamics, including drug absorption, distribution, metabolism, elimination, and receptor interactions.	Ap
2	Explain the mechanisms of neurotransmission in both autonomic and central nervous systems, and describe the role of major neurotransmitters.	Ap
3	Analyze the pharmacology, mechanism of action, and therapeutic use of drugs affecting the central nervous system, including anesthetics, psychotropics, and analgesics.	U
4	Describe cardiovascular pharmacology, including drugs used for hypertension, heart failure, arrhythmias, and blood disorders.	An
5	Evaluate the physiological and pathological roles of autocoids such as histamine, serotonin, prostaglandins, and opioid autacoids, along with their pharmacological antagonists.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	3	2	2	3	1	2	2	2	3	2	3	2	2
CO2	3	3	3	3	2	3	3	1	2	2	2	3	3	3	2	2
CO3	3	3	3	3	3	2	2	1	3	3	2	3	3	3	3	3
CO4	3	2	3	3	2	2	2	1	3	3	2	3	3	3	3	3
CO5	3	3	2	3	3	2	3	2	3	3	2	2	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**General Pharmacology** a. Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Concepts of linear and non-linear compartment models. Significance of Protein binding. b. Pharmacodynamics: Mechanism of drug action and the relationship between drug concentration and effect. Receptors, structural and functional families of receptors, quantitation of drug receptors interaction and elicited effects.	12	1
II	**Neurotransmission** a. General aspects and steps involved in neurotransmission. b. Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters- Adrenaline and Acetyl choline). c. Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters- histamine, serotonin, dopamine, GABA, glutamate and glycine]. d. Non adrenergic non cholinergic transmission (NANC). Co-transmission **Systemic Pharmacology** A detailed study on pathophysiology of diseases, mechanism of action, pharmacology and toxicology of existing as well as novel drugs used in the following systems **Autonomic Pharmacology** Parasympathomimetics and lytics, sympathomimetics and lytics, agents affecting neuromuscular junction	12	2
III	**Central nervous system Pharmacology** General and local anesthetics Sedatives and hypnotics, drugs used to treat anxiety. Depression, psychosis, mania, epilepsy, neurodegenerative diseases. Narcotic and non-narcotic analgesics.	12	3
IV	**Cardiovascular Pharmacology** Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia.	12	4

	Hematinics, coagulants , anticoagulants, fibrinolytics and anti- platelet drugs		
V	**Autocoid Pharmacology** The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins Opioid autocoids. Pharmacology of antihistamines, 5HT antagonists.	12	5

Books Recommended:

1. The Pharmacological Basis of Therapeutics, Goodman and Gillman's
2. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan, Armen H, Tashjian Jr, Ehrin J,Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
3. Basic and Clinical Pharmacology by B.G Katzung
4. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
5. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
6. Graham Smith. Oxford textbook of Clinical Pharmacology.
7. Avery Drug Treatment
8. Dipiro Pharmacology, Pathophysiological approach.
9. Green Pathophysiology for Pharmacists.
10. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
11. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company
12. KD.Tripathi. Essentials of Medical Pharmacology.
13. Modern Pharmacology with Clinical Applications, Craig Charles R. & Stitzel Robert E., Lippincott Publishers.
14. Clinical Pharmacokinetics & Pharmacodynamics: Concepts and Applications – Malcolm Rowland and Thomas N.Tozer, Wolters Kluwer, Lippincott Williams & Wilkins Publishers.
15. Applied biopharmaceutics and Pharmacokinetics, Pharmacodynamics and Drug metabolism for industrial scientists.
16. Modern Pharmacology, Craig CR. & Stitzel RE, Little Brown & Company.

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	I	I
Course Code	Course Title		Course Type
MPL 103T	PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS - I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	–	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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

- Appraise the regulations and ethical requirement for the usage of experimental animals.
- Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals
- Describe the various newer screening methods involved in the drug discovery process
- Appreciate and correlate the preclinical data to humans

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Describe common laboratory animals, transgenic models, ethical guidelines (CPCSEA), and principles of anesthesia and euthanasia in animal experimentation	Ap
2	Demonstrate knowledge of preclinical screening methods using in vivo, in vitro, and alternative models focusing on CNS and autonomic nervous system pharmacology.	Ap
3	Evaluate preclinical pharmacological activity of new substances on respiratory, reproductive, gastrointestinal, and anti-inflammatory drug classes.	U
4	Analyze preclinical screening of cardiovascular, metabolic, anticancer, and hepatoprotective agents using experimental models.	An
5	Understand immunopharmacology concepts including immunoassays, immunomodulators, and limitations of animal experimentation with alternatives and data extrapolation.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	2	2	3	2	3	2	1	3	3	2	3	2
CO2	3	3	3	3	2	2	3	1	2	3	2	3	3	3	2	3
CO3	3	3	3	3	2	2	2	1	2	3	2	3	2	3	3	3
CO4	3	2	3	3	2	2	2	1	2	3	2	3	2	3	3	3
CO5	3	3	2	3	2	2	3	2	3	3	2	2	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Laboratory Animals** Common laboratory animals: Description, handling and applications of different species and strains of animals. Transgenic animals: Production, maintenance and applications Anaesthesia and euthanasia of experimental animals. Maintenance and breeding of laboratory animals. CPCSEA guidelines to conduct experiments on animals Good laboratory practice. Bioassay-Principle, scope and limitations and methods	12	1
II	**Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.** General principles of preclinical screening. CNS Pharmacology: behavioral and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti- epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimers and multiple sclerosis. Drugs acting on Autonomic Nervous System.	12	2
III	**Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.** Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, antiinflammatory and antipyretic agents. Gastrointestinal drugs: anti-ulcer, anti -emetic, anti- diarrheal and laxatives.	12	3
IV	**Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.** Cardiovascular Pharmacology: antihypertensives, antiarrythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents. Anti cancer agents. Hepatoprotective screening methods.	12	4

V	Preclinical screening of new substances for the pharmacological activity using *in vivo, in vitro*, and other possible animal alternative models. Iimmunomodulators, Immunosuppressants and immunostimulants **General principles of immunoassay:** theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems. Immunoassay methods evaluation; protocol outline, objectives and preparation. Immunoassay for digoxin and insulin Limitations of animal experimentation and alternate animal experiments. Extrapolation of *in vitro* data to preclinical and preclinical to humans.	12	5

Books Recommended:

1. Biological standardization by J.H. Burn D.J. Finney and I.G. Goodwin
2. Screening methods in Pharmacology by Robert Turner. A
3. Evaluation of drugs activities by Laurence and Bachrach
4. Methods in Pharmacology by Arnold Schwartz.
5. Fundamentals of experimental Pharmacology by M.N.Ghosh
6. Pharmacological experiment on intact preparations by Churchill Livingstone
7. Drug discovery and Evaluation by Vogel H.G.
8. Experimental Pharmacology by R.K.Goyal.
9. Preclinical evaluation of new drugs by S.K. Guta
10. Handbook of Experimental Pharmacology, SK.Kulkarni
11. Practical Pharmacology and Clinical Pharmacy, SK.Kulkarni, 3rd Edition.
12. David R.Gross. Animal Models in Cardiovascular Research, 2nd Edition, Kluwer Academic Publishers, London, UK.
13. Screening Methods in Pharmacology, Robert A.Turner.
14. Rodents for Pharmacological Experiments, Dr.Tapan Kumar chatterjee.
15. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash (Author)

Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	I	I
Course Code	Course Title		Course Type
MPL 104T	CELLULAR AND MOLECULAR PHARMACOLOGY		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	--	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

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

- Explain the receptor signal transduction processes.
- Explain the molecular pathways affected by drugs.
- Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process.
- Demonstrate molecular biology techniques as applicable for pharmacology

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the structure and function of cells, genome organization, gene expression regulation, and mechanisms of cell death (apoptosis, necrosis, autophagy).	Ap
2	Explain various cell signaling pathways, receptor classifications, and roles of secondary messengers in intracellular communication.	Ap
3	Apply knowledge of genomic and proteomic tools including PCR, gene sequencing, recombinant DNA technology, and gene therapy.	U
4	Analyze the impact of genetic variation on drug response and explore the principles and applications of pharmacogenomics and immunotherapeutics.	An
5	Demonstrate practical knowledge of cell culture techniques, viability assays, flow cytometry, and understand the concept of biosimilars.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	1	2	2	2	3	2	3	2	2
CO2	3	3	3	3	2	2	3	1	2	2	2	3	3	3	2	2
CO3	3	3	3	3	3	2	3	1	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	2	3	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	1	2	3	2	3	2	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

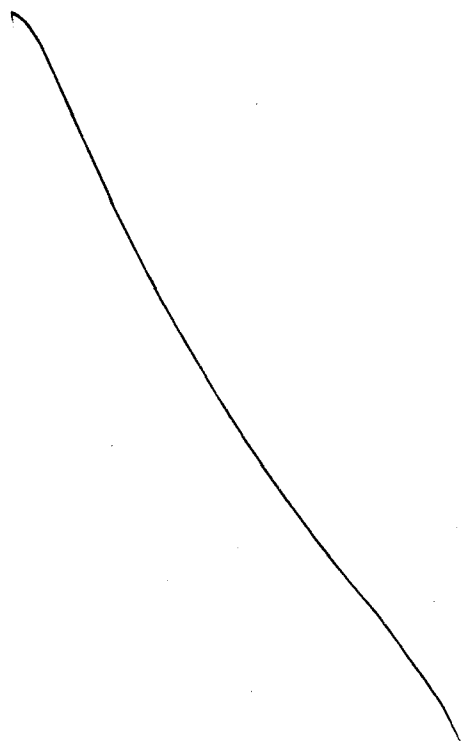
Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Cell biology** Structure and functions of cell and its organelles Genome organization. Gene expression and its regulation, importance of siRNA and micro-RNA, gene mapping and gene sequencing Cell cycles and its regulation. Cell death– events, regulators, intrinsic and extrinsic pathways of apoptosis. Necrosis and autophagy.	12	1
II	**Cell signaling** Intercellular and intracellular signaling pathways. Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors. Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol 1,4,5-trisphosphate, (IP3), NO, and diacylglycerol. Detailed study of following intracellular signaling pathways: cyclic AMP signaling pathway, mitogen-activated protein kinase (MAPK) signaling, Janus kinase (JAK)/signal transducer and activator of transcription (STAT) signaling pathway.	12	2
III	**Principles and applications of genomic and proteomic tools** DNA electrophoresis, PCR (reverse transcription and real time), Gene sequencing, micro array technique, SDS page, ELISA and western blotting, Recombinant DNA technology and gene therapy Basic principles of recombinant DNA technology-Restriction enzymes, various types of vectors. Applications of recombinant DNA technology. Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy	12	3
IV	**Pharmacogenomics** Gene mapping and cloning of disease gene. Genetic variation and its role in health/ pharmacology Polymorphisms affecting drug metabolism Genetic variation in drug transporters Genetic variation in G protein coupled receptors Applications of proteomics science: Genomics, proteomics, metabolomics, functionomics, nutrigenomics **Immunotherapeutics** Types of immunotherapeutics, humanisation antibody therapy, Immunotherapeutics in clinical practice	12	4

V	a. **Cell culture techniques** Basic equipments used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of cells and their application. Principles and applications of cell viability assays, glucose uptake assay, Calcium influx assays Principles and applications of flow cytometry b. **Biosimilars**	12	5

Books Recommended:

1. The Cell, A Molecular Approach. Geoffrey M Cooper.
2. Pharmacogenomics: The Search for Individualized Therapies. Edited by J. Licinio and M -L. Wong
3. Handbook of Cell Signaling (Second Edition) Edited by Ralph A. et.al
4. Molecular Pharmacology: From DNA to Drug Discovery. John Dickenson et.al
5. Basic Cell Culture protocols by Cheril D.Helgason and Cindy L.Miller
6. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
7. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
8. Current porotocols in molecular biology vol I to VI edited by Frederick M.Ausuvel et la.



Semester-I

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	I
Course Code	Course Title		Course Type
MPL 105P	PHARMACOLOGY PRACTICAL - I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
06	-	–	12

Maximum Marks	CIA	ESE
150	50	100

Learning Objective (LO):

Course Objectives

- Understand the principles of instrumental techniques such as UV-Vis, HPLC, GC, flame photometry, and fluorimetry for analysis of drugs and biomolecules.
- Apply pharmacological and toxicological methods using laboratory animals for evaluating drug effects through various in vivo and in vitro models.
- Demonstrate molecular biology techniques including DNA/RNA isolation, PCR, and protein analysis to explore drug interactions at the cellular and genetic levels.
- Evaluate pharmacodynamic effects such as CNS activity, analgesic, anti-inflammatory, antiulcer, and diuretic activities using validated models.
- Analyze pharmacokinetic data and understand drug behavior in biological systems using computational and experimental methods.
- Integrate enzymatic assays, cell-based assays, and in vitro models for understanding drug toxicity, enzyme kinetics, and apoptosis.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Describe the fundamentals and uses of spectrofluorimetric, UV, HPLC, and GC methods in drug analysis.	Ap
2	To evaluate CNS, analgesic, anti-inflammatory, and antiulcer activities, perform pharmacological experiments, handle laboratory animals, and administer medications.	Ap
3	Utilising PCR and Western blotting methods, separate and measure the DNA, RNA, and proteins from biological materials. Assess gene amplification and protein expression.	U
4	To ascertain drug absorption, metabolism, and elimination, perform pharmacokinetic and enzyme activity studies utilising the proper software and analytical methods.	An
5	Create and carry out in vitro tests to evaluate cell viability, genotoxicity, and enzyme modulation (e.g., MTT, Comet assay, enzyme inhibition).	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	4	2	1	3	1	1	2	1	5	4	2	1	2
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CO3	3	3	3	4	3	2	3	3	1	3	2	5	4	2	3	5
CO4	3	3	2	3	2	2	3	2	1	3	1	4	3	3	2	5
CO5	3	4	3	4	3	2	3	3	2	3	2	5	4	2	3	5

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

LIST OF PRACTICALS

1. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry

Handling of laboratory animals.

1. Various routes of drug administration.
2. Techniques of blood sampling, anesthesia and euthanasia of experimental animals.
3. Functional observation battery tests (modified Irwin test)
4. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity.
5. Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.
6. Evaluation of diuretic activity.
7. Evaluation of antiulcer activity by pylorus ligation method.
8. Oral glucose tolerance test.
9. Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver).
10. Isolation of RNA from yeast
11. Estimation of proteins by Braford/Lowry's in biological samples.
12. Estimation of RNA/DNA by UV Spectroscopy
13. Gene amplification by PCR.
14. Protein quantification Western Blotting.
15. Enzyme based *in-vitro* assays (MPO, AChEs, α amylase, α glucosidase).
16. Cell viability assays (MTT/Trypan blue/SRB).
17. DNA fragmentation assay by agarose gel electrophoresis.
18. DNA damage study by Comet assay.
19. Apoptosis determination by fluorescent imaging studies.
20. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares

21. Enzyme inhibition and induction activity
22. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)
23. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (HPLC)

Books Recommended:

1. CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines,
2. Fundamentals of experimental Pharmacology by M.N.Ghosh
3. Handbook of Experimental Pharmacology by S.K. Kulkarni.
4. Drug discovery and Evaluation by Vogel H.G.
5. Spectrometric Identification of Organic compounds - Robert M Silverstein,
6. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman,
7. Vogel's Text book of quantitative chemical analysis - Jeffery, Basset, Mendham, Denney,
8. Basic Cell Culture protocols by Cheril D. Helgason and Cindy L.Mille
9. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
10. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
11. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash (Author) Jaypee brothers' medical publishers Pvt. Ltd

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	II
Course Code	Course Title		Course Type
MPL 201T	Advanced Pharmacology-II		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	–	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

- Explain the mechanism of drug actions at cellular and molecular level
- Discuss the Pathophysiology and pharmacotherapy of certain diseases
- Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain molecular and cellular mechanisms of hormone action and pharmacology of drugs affecting endocrine systems including thyroid, insulin, corticosteroids, and calcium regulation.	Ap
2	Analyze mechanisms of action, resistance, and pharmacology of antimicrobial agents including antibiotics, antifungals, antivirals, and anti-tubercular drugs.	Ap
3	Understand chemotherapy of protozoal, helminthic infections, cancer, and immunopharmacology including inflammation, hypersensitivity, and immunomodulatory drugs.	U
4	Describe pharmacology of gastrointestinal drugs and chronopharmacology with applications in various diseases.	An
5	Evaluate the role of free radicals in disease pathophysiology and the pharmacological advances in treatment of neurodegenerative diseases, cancer, and diabetes.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	2	3	2	2	3	2	3	2	3	2	3
CO2	3	3	3	3	2	2	3	2	2	3	2	3	3	3	3	3
CO3	3	3	3	3	2	2	3	2	2	3	2	3	3	3	3	3
CO4	3	2	2	2	2	2	3	1	2	3	2	2	2	2	2	2
CO5	3	3	3	3	2	2	3	2	2	3	3	2	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Endocrine Pharmacology** Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones Anti-thyroid drugs, Oral hypoglycemic agents, Oral contraceptives, Corticosteroids. Drugs affecting calcium regulation	12	1
II	**Chemotherapy** Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as ß-lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral, and anti-TB drugs.	12	2
III	**Chemotherapy** Drugs used in Protozoal Infections Drugs used in the treatment of Helminthiasis Chemotherapy of cancer, **Immunopharmacology** Cellular and biochemical mediators of inflammation and immune response. Allergic or hypersensitivity reactions. Pharmacotherapy of asthma and COPD. Immunosuppressants and Immunostimulants	12	3
IV	**GIT Pharmacology** Antiulcer drugs, Prokinetics, antiemetics, anti-diarrheals and drugs for constipation and irritable bowel syndrome. Chronopharmacology Biological and circadian rhythms, applications of chronotherapy in various diseases like cardiovascular disease, diabetes, asthma and peptic ulcer	12	4
V	**Free radicals Pharmacology** Generation of free radicals, role of free radicals in etiopathology of various diseases such as diabetes, neurodegenerative diseases and cancer. Protective activity of certain important antioxidant **Recent Advances in Treatment:** Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus	12	5

Books Recommended:

1. The Pharmacological basis of therapeutics- Goodman and Gill man's
2. Principles of Pharmacology. The Pathophysiologic basis of drug therapy by David E Golan et al.
3. Basic and Clinical Pharmacology by B.G -Katzung

4. Pharmacology by H.P. Rang and M.M. Dale.
5. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
6. Text book of Therapeutics, drug and disease management by E T. Herfindal and Gourley.
7. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
8. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists
9. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
10. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company.
11. KD.Tripathi. Essentials of Medical Pharmacology
12. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan, Armen H, Tashjian Jr, Ehrin J,Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	I	II
Course Code	Course Title		Course Type
MPL 202T	Pharmacological and Toxicological Screening Methods-II		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	--	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

- Explain the various types of toxicity studies.
- Appreciate the importance of ethical and regulatory requirements for toxicity studies.
- Demonstrate the practical skills required to conduct the preclinical toxicity studies.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the basic concepts and types of toxicology, including regulatory toxicology guidelines and Good Laboratory Practices (GLP).	Ap
2	Describe protocols for acute, sub-acute, and chronic toxicity studies including dermal, inhalational, and ocular toxicity as per OECD guidelines.	Ap
3	Explain reproductive, genotoxicity, and carcinogenicity toxicology studies, including various standard tests used in regulatory toxicology.	U
4	Comprehend Investigational New Drug (IND) enabling studies, their regulatory importance, and the types of safety pharmacology studies (Tier 1 and Tier 2).	An
5	Understand toxicokinetics and its role in preclinical safety assessment, including alternative methods to animal testing.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	1	3	2	3	2	2	2	3	2	3	2
CO2	3	3	3	3	2	1	3	2	3	3	2	3	3	3	3	2
CO3	3	3	3	3	2	1	3	2	3	3	2	3	3	3	3	2
CO4	3	3	3	3	2	1	3	3	3	3	2	3	3	3	3	2
CO5	3	3	3	3	2	1	3	2	3	3	2	3	3	3	3	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	Basic definition and types of toxicology (general, mechanistic, regulatory and descriptive) Regulatory guidelines for conducting toxicity studies OECD, ICH, EPA and Schedule Y OECD principles of Good laboratory practice (GLP) History, concept and its importance in drug development	12	1
II	Acute, sub-acute and chronic- oral, dermal and inhalational studies as per OECD guidelines. Acute eye irritation, skin sensitization, dermal irritation & dermal toxicity studies. Test item characterization- importance and methods in regulatory toxicology studies	12	2
III	Reproductive toxicology studies, Male reproductive toxicity studies, female reproductive studies (segment I and segment III), teratogenecity studies (segment II) Genotoxicity studies (Ames Test, *in vitro* and *in vivo* Micronucleus and Chromosomal aberrations studies) *In vivo* carcinogenicity studies	12	3
IV	IND enabling studies (IND studies)- Definition of IND, importance of IND, industry perspective, list of studies needed for IND submission. Safety pharmacology studies- origin, concepts and importance of safety pharmacology. Tier1- CVS, CNS and respiratory safety pharmacology, HERG assay. Tier2- GI, renal and other studies	12	4
V	Toxicokinetics- Toxicokinetic evaluation in preclinical studies, saturation kinetics Importance and applications of toxicokinetic studies. Alternative methods to animal toxicity testing.	12	5

Books Recommended:

1. Hand book on GLP, Quality practices for regulated non-clinical research and development (http://www.who.int/tdr/publications/documents/glp- handbook.pdf).
2. Schedule Y Guideline: drugs and cosmetics (second amendment) rules, 2005, ministry of health and family welfare (department of health) New Delhi
3. Drugs from discovery to approval by Rick NG.
4. Animal Models in Toxicology, 3rd Edition, Lower and Bryan
5. OECD test guidelines.
6. Principles of toxicology by Karen E. Stine, Thomas M. Brown.
7. Guidance for Industry M3(R2) Nonclinical Safety Studies for the Conduct of Human Clinical Trials and Marketing Authorization for Pharmaceuticals (http://www.fda.gov/downloads/drugs/guidancecomplianceregulatoryinformation/guidances/ucm073246.pdf).

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	I	II
Course Code	Course Title		Course Type
MPL 203T	Principles of Drug Discovery		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	--	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

- Explain the various stages of drug discovery.
- Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery
- Explain various targets for drug discovery.
- Explain various lead seeking method and lead optimization
- Appreciate the importance of the role of computer aided drug design in drug discovery

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain the modern drug discovery process, including target identification, validation, and the role of genomics, proteomics, and bioinformatics in drug discovery.	Ap
2	Understand lead identification techniques including combinatorial chemistry, high throughput screening, and protein structure prediction methods.	Ap
3	Differentiate between traditional and rational drug design methods and apply concepts of pharmacophore-based approaches and virtual screening techniques.	U
4	Describe molecular docking techniques, de novo drug design, and perform quantitative structure-activity relationship (QSAR) analyses.	An
5	Apply statistical methods used in QSAR and understand prodrug design principles for improving drug properties and delivery.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	3	2	2	3	3	2	2	3	3	3	3	2	2
CO2	3	3	3	3	2	1	3	2	2	2	2	3	3	3	2	2
CO3	3	3	3	3	2	2	3	3	2	3	3	3	3	3	2	2
CO4	3	3	3	3	2	2	3	3	2	3	3	3	3	3	2	2
CO5	3	3	3	3	2	1	3	3	2	3	3	3	3	3	2	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**An overview of modern drug discovery process:** Target identification, target validation, lead identification and lead Optimization. Economics of drug discovery. **Target Discovery and validation**-Role of Genomics, Proteomics and Bioinformatics. Role of Nucleic acid microarrays, Protein microarrays, Antisense technologies, siRNAs, antisense oligonucleotides, Zinc finger proteins. Role of transgenic animals in target validation.	12	1
II	**Lead Identification**- combinatorial chemistry & high throughput screening, in silico lead discovery techniques, Assay development for hit identification. **Protein structure** Levels of protein structure, Domains, motifs, and folds in protein structure. Computational prediction of protein structure: Threading and homology modeling methods. Application of NMR and X-ray crystallography in protein structure prediction	12	2
III	**Rational Drug Design** Traditional vs rational drug design, Methods followed in traditional drug design, High throughput screening, Concepts of Rational Drug Design, Rational Drug Design Methods: Structure and Pharmacophore based approaches Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening	12	3
IV	**Molecular docking:** Rigid docking, flexible docking, manual docking; Docking based screening. De novo drug design. Quantitative analysis of Structure Activity Relationship History and development of QSAR, SAR versus QSAR, Physicochemical parameters, Hansch analysis, Fee Wilson analysis and relationship between them.	12	4
V	**QSAR Statistical methods** – regression analysis, partial least square analysis (PLS) and other multivariate statistical methods. 3D-QSAR approaches like COMFA and COMSIA Prodrug design-Basic concept, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design	12	5

Books Recommended:

1. Mouldy Sioud. Target Discovery and Validation Reviews and Protocols: Volume 2 Emerging Molecular Targetsand Treatment Options. 2007 Humana Press Inc.
2. Darryl León. Scott MarkelIn. Silico Technologies in Drug Target Identification and Validation. 2006 by Taylor and Francis Group, LLC.
3. Johanna K. DiStefano. Disease Gene Identification. Methods and Protocols. Springer New York Dordrecht Heidelberg London.
4. Hugo Kubiny. QSAR: Hansch Analysis and Related Approaches. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH
5. Klaus Gubernator, Hans-Joachim Böhm. Structure-Based Ligand Design. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH
6. Abby L . Parrill. M . Rami Reddy. Rational Drug Design. Novel Methodology and Practical Applications. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.
7. J. Rick Turner. New drug development design, methodology and, analysis. John Wiley & Sons, Inc., New Jersey

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	II
Course Code	Course Title		Course Type
MPL 204T	Clinical Research and Pharmacovigilance		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	–	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

Explain the regulatory requirements for conducting clinical trial

- Demonstrate the types of clinical trial designs
- Explain the responsibilities of key players involved in clinical trials
- Execute safety monitoring, reporting and close-out activities
- Explain the principles of Pharmacovigilance
- Detect new adverse drug reactions and their assessment
- Perform the adverse drug reaction reporting systems and communication in Pharmacovigilance

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Understand regulatory frameworks, ethical guidelines, and informed consent processes governing clinical trials (ICH-GCP, Schedule Y, ICMR).	Ap
2	Explain various clinical trial designs, study team roles, and responsibilities in clinical research.	Ap
3	Prepare and manage clinical trial documentation and monitor safety including adverse drug reaction (ADR) reporting and management.	U
4	Comprehend the principles, history, and functioning of pharmacovigilance systems at national and international levels.	An
5	Apply methods, tools, and statistical approaches used in pharmacovigilance, and understand basic pharmacoepidemiology and pharmacoeconomics concepts.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	3	3	2	3	2	3	2	3	2
CO2	3	3	3	2	3	3	2	2	3	2	3	2	3	2	3	3
CO3	3	3	3	3	3	2	2	2	3	2	3	2	3	2	3	3
CO4	3	3	2	2	2	3	3	3	3	2	3	2	3	3	3	3
CO5	3	3	3	3	3	2	2	3	3	2	3	2	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**Regulatory Perspectives of Clinical Trials:** Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines **Ethical Committee:** Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant- Schedule Y, ICMR **Informed Consent Process:** Structure and content of an Informed Consent Process Ethical principles governing informed consent process	12	1
II	**Clinical Trials:** Types and Design Experimental tudy- RCT and Non RCT, Observation Study: Cohort, Case Control, Cross sectional **Clinical Trial Study Team** Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management .	12	2
III	**Clinical Trial Documentation-** Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring- Safety Monitoring in CT **Adverse Drug Reactions:** Definition and types. Detection and reporting methods. Severity and seriousness assessment. Predictability and preventability assessment, Management of adverse drug reactions; Terminologies of ADR	12	3
IV	**Basic aspects, terminologies and establishment of pharmacovigilance** History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance	12	4
V	**Methods, ADR reporting and tools used in Pharmacovigilance** International classification of diseases, International Non- proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, Targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for	12	5

	evaluating medication safety data.		
VI	**Pharmacoepidemiology, pharmacoeconomics, safety pharmacology**	12	6

Books Recommended:

1. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health;2001.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
6. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.
7. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	I	II
Course Code	Course Title		Course Type
MPL 205P	PHARMACOLOGICAL PRACTICAL - II		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
06	-	–	12

Maximum Marks	CIA	ESE
150	50	100

Learning Objective (LO):

- Use in vivo preparations and isolated tissue to comprehend the fundamentals of drug action and interaction.
- Utilise bioassay methods to assess pharmacological reactions and drug potency.
- Exhibit in vivo experimental protocols for laboratory animal cardiovascular and toxicological evaluations.
- Using biochemical, haematological, and histological parameters, analyse toxicological profiles in accordance with OECD recommendations.
- Analyse and create in-silico techniques for drug discovery and safety, clinical trial protocols, and ADR monitoring systems.
- Combine your understanding of computational methods and pharmacological tools to screen for toxicity, receptor binding, and drug likeness

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Describe the ideas of receptor antagonism in isolated tissue models, bioassay techniques, and dose-response curves (DRC).	Ap
2	Using appropriate tissue preparations, conduct and interpret a variety of bioassays, including matching, interpolation, bracketing, and multiple-point assays.	Ap
3	Use isolated heart preparation and in vivo rat ECG/BP monitoring to examine the pharmacological reactions of cardiovascular medications.	U
4	Use chromosomal aberration tests and standardised OECD protocols to evaluate the mutagenic potential and acute and repeated dose toxicity profiles of medications.	An
5	Create ADR monitoring systems, clinical trial protocols, and ADR reports while adhering to ethical and legal requirements.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	4	2	1	3	1	1	2	1	5	4	2	1	2
CO2	2	3	3	3	1	3	2	3	2	1	1	4	3	3	4	2
CO3	3	3	3	4	3	2	3	3	1	3	2	5	4	2	3	5
CO4	3	3	2	3	2	2	3	2	1	3	1	4	3	3	2	5
CO5	3	4	3	4	3	2	3	3	2	3	2	5	4	2	3	5

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

LIST OF PRACTICALS
1. To record the DRC of agonist using suitable isolated tissues preparation. 2. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation. 3. To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation. 4. To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation 5. To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation 6. To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation. 7. Estimation of PA2 values of various antagonists using suitable isolated tissue preparations. 8. To study the effects of various drugs on isolated heart preparations 9. Recording of rat BP, heart rate and ECG. 10. Recording of rat ECG 11. Drug absorption studies by averted rat ileum preparation. 12. Acute oral toxicity studies as per OECD guidelines. 13. Acute dermal toxicity studies as per OECD guidelines. 14. Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies. 15. Drug mutagenicity study using mice bone-marrow chromosomal aberration test. 16. Protocol design for clinical trial.(3 Nos.) 17. Design of ADR monitoring protocol. 18. *In-silico* docking studies. (2 Nos.) 19. *In-silico* pharmacophore based screening. 20. *In-silico* QSAR studies. 21. ADR reporting

Books Recommended:

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. Text book of *in-vitro* practical Pharmacology by Ian Kitchen
4. Bioassay Techniques for Drug Development by Atta-ur-Rahman, Iqbal choudhary and William Thomsen
5. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
6. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists

Semester-II

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	1	II
Course Code	Course Title		Course Type
--	Seminar /Assignment		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	–	–	--

Maximum Marks	CIA	ESE
100	--	100

Learning Objective (LO):

The subject is designed to create an environment where teachers provide the students a critical eye and openness to fortify the presentation and academic writing skills of students in the field of Pharmaceutics and industrial pharmacy.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Develop skills to gather, organize, deliver information, and defend a given topic in Pharmaceutics and industrial pharmacy.	Ap
2	Learn to organize complex concepts using audio-visual aids.	Ap
3	Acquire communication and presentation skills.	U
4	Effectively respond to questions raised by peers and stand scientific scrutiny.	An
5	Develop a write-up on the subject of seminar presentation and cultivate continuous learning.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	3	2	2	2	3	2	2	2	2
CO2	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2	2
CO3	3	3	3	3	2	2	2	3	3	3	3	3	2	2	2	2
CO4	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2
CO5	3	3	3	2	3	3	2	2	2	2	3	3	3	3	3	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
MPL 301T	**Research Methodology and Biostatistics**		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	4	–	--

Maximum Marks	CIA	ESE
100	25	75

Learning Objective (LO):

- Understand the fundamentals of research methodology including study designs, bias elimination, controls, and randomization techniques.
- Apply biostatistical methods for analyzing data, interpreting statistical tests, and understanding the role of sample size in research.
- Comprehend the ethical principles and dilemmas in medical research, including patient autonomy, informed consent, confidentiality, and conflicts of interest.
- Learn the CPCSEA guidelines for proper laboratory animal care and management in compliance with ethical and regulatory standards.
- Recognize the significance of the Declaration of Helsinki in framing ethical standards for medical research involving human subjects.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Explain general research methodology, including study designs, bias elimination, controls, randomization, and blinding techniques.	Ap
2	Apply biostatistical concepts including sample size determination, parametric and non-parametric tests, and interpretation of results.	Ap
3	Discuss medical ethics principles, including autonomy, beneficence, informed consent, confidentiality, and ethical dilemmas.	U
4	Understand and implement CPCSEA guidelines for ethical treatment and management of laboratory animals in research facilities.	An
5	Describe the history, principles, and applications of the Declaration of Helsinki for ethical medical research.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	4	4	3	3	2	1	3	1	1	2	1	2	2	2	1	2
CO2	4	4	4	5	2	1	4	1	1	2	1	3	4	2	1	3
CO3	3	4	4	2	4	3	3	2	4	3	3	2	2	3	1	2
CO4	3	3	3	2	2	2	2	2	4	2	1	4	2	3	5	3
CO5	3	3	3	2	2	2	3	2	5	2	2	3	3	3	2	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Detailed Syllabus:

Unit No.	Topics	No. of Lectures	CO No.
I	**General Research Methodology:** Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.	4	1
II	**Biostatistics:** Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests(students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.	4	2
III	**Medical Research:** History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.	4	3
IV	**CPCSEA guidelines for laboratory animal facility:** Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.	4	4
V	**Declaration of Helsinki:** History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	4	5

Books Recommended:

1. Research Methodology: Methods and Techniques by C.R. Kothari
2. Biostatistics: A Foundation for Analysis in the Health Sciences by Wayne W. Daniel and Chad L. Cross
3. Statistical Methods for Practice and Research by Ajai S. Gaur and Sanjaya S. Gaur
4. Principles of Biomedical Ethics by Tom L. Beauchamp and James F. Childress
5. Medical Ethics: Accounts of Ground-Breaking Cases by Gregory Pence
6. Ethics and the Practice of Psychology by Gerald P. Koocher and Patricia Keith-Spiegel
7. Guide for the Care and Use of Laboratory Animals by Institute for Laboratory Animal Research (ILAR)
8. CPCSEA Guidelines on Laboratory Animal Facilities and Ethics
9. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
	JOURNAL CLUB		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
1	1	–	--

Maximum Marks	CIA	ESE
75	25	-

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Organize and present complex research concepts effectively using audio-visual aids.	Ap
2	Develop strong communication and presentation skills in the context of scientific research.	Ap
3	Critically analyze published research papers and respond effectively to scientific queries and scrutiny	U
4	Understand and apply principles of research methodology, ethics, and biostatistics in research analysis.	An
5	Foster continuous self-learning and knowledge upgradation in advanced research techniques.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	2	2	2	3	3	2	2	2	3	2	2	2	2
CO2	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	2	2	2	2	3	3	3	3	3	2

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
	DISCUSSION / PRESENTATION (PROPOSAL PRESENTATION)		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	--	--

Maximum Marks	CIA	ESE
50	50	--

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of clear vision and well-defined objectives in pharmaceutical research	Ap
2	Identify and analyze the key components of vision and objectives statements in research proposals.	Ap
3	Develop a comprehensive and coherent vision and objectives statement for pharmaceutical research projects.	U
4	Enhance scientific communication and presentation skills through proposal and final presentations.	An
5	Critically evaluate peer presentations and provide constructive feedback to improve research quality.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	1	2	1	1	1	1	1	3	2	1	2	2
CO2	3	3	2	2	1	2	2	2	1	1	1	3	2	1	2	2
CO3	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO4	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO5	3	3	3	3	2	3	3	3	3	2	2	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-III

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
	RESEARCH WORK		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
14	--	--	28

Maximum Marks	CIA	ESE
350	--	350

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Design, conduct, and analyze original pharmaceutical research to contribute to the advancement of knowledge in pharmacy	Ap
2	Apply theoretical and practical knowledge to solve real-world pharmaceutical problems, develop research hypotheses, and critically evaluate scientific literature	Ap
3	Develop research skills including study design, data collection, analysis, interpretation, and prepare scientific manuscripts and presentations	U
4	Demonstrate expertise in a specific pharmacy area and innovate new methodologies or technologies to improve pharmaceutical practice and patient care.	An
5	Effectively communicate and present research findings through scientific writing, posters, and oral presentations to prepare for research and academic careers.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO2	3	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2
CO3	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester- IV

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
	DISCUSSION / PRESENTATION (PROPOSAL PRESENTATION)		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	--	--

Maximum Marks	CIA	ESE
75	75	--

Learning Objective (LO):

The subject is designed to create an environment where students present a published research paper, and critically analyse it, that would enhance the communication, presentation and analytical skills of the students. This subject is designed to understand the advanced knowledge for research methodology, ethics in research, medical research, design, conduct and interpretation of results. This subject deals with principles of statistics and their applications in biostatistics involving parametric tests, non-parametric tests, correlation, regression, probability theory and statistical hypotheses.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Understand the significance of clear vision and well-defined objectives in pharmaceutical research	Ap
2	Identify and analyze the key components of vision and objectives statements in research proposals.	Ap
3	Develop a comprehensive and coherent vision and objectives statement for pharmaceutical research projects.	U
4	Enhance scientific communication and presentation skills through proposal and final presentations.	An
5	Critically evaluate peer presentations and provide constructive feedback to improve research quality.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	2	2	1	2	1	1	1	1	1	3	2	1	2	2
CO2	3	3	2	2	1	2	2	2	1	1	1	3	2	1	2	2
CO3	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO4	3	3	3	2	2	2	2	3	2	2	2	3	2	2	2	2
CO5	3	3	3	3	2	3	3	3	3	2	2	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester-IV

Program	Subject	Year	Semester
M. Pharm.	Pharmacology	2	III
Course Code	Course Title		Course Type
	RESEARCH WORK		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
31	--	–	16

Maximum Marks	CIA	ESE
400	--	400

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to :	CL
1	Design, conduct, and analyze original pharmaceutical research to contribute to the advancement of knowledge in pharmacy	Ap
2	Apply theoretical and practical knowledge to solve real-world pharmaceutical problems, develop research hypotheses, and critically evaluate scientific literature	Ap
3	Develop research skills including study design, data collection, analysis, interpretation, and prepare scientific manuscripts and presentations	U
4	Demonstrate expertise in a specific pharmacy area and innovate new methodologies or technologies to improve pharmaceutical practice and patient care.	An
5	Effectively communicate and present research findings through scientific writing, posters, and oral presentations to prepare for research and academic careers.	U

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	3	2	2	2	2	2	3	3	2	3	3
CO2	3	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2
CO3	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3

"3" – Strong; "2" – Moderate; "1"- Low; "-" No Correlation

Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations andOther Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

Guidelines for Awarding Credit Points for Co-curricular Activities

Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	01
Participation in international Level Seminar/ Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science)	02

Note: International Conference: Held Outside India
International Journal: The Editorial Board Outside India

*The credit points assigned for extracurricular and or co-curricular activities shallbe given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.