

GANPAT UNIVERSITY**FACULTY OF PHARMACY****TEACHING AND EXAMINATION SCHEME**

Program	Master of Pharmacy (M.Pharm)	Branch	Pharmacology	Semester	1	Version	2.0.0.0		
Effective from	2018-19	Effective for batches admitted onwards	2018-19						
S. N	Subject Code	Subject Name	Theory / Practical/ Seminar	Teaching Scheme		Examination Scheme			
				Credit	Hours Per Week	Marks			Total Marks
CE	SE	ES							
1	MAT101T	Modern Pharmaceutical Analytical Techniques	Theory	4	4	10	15	75	100
2	MPL102T	Advanced Pharmacology-I	Theory	4	4	10	15	75	100
3	MPL103T	Pharmacological and Toxicological Screening Methods-I	Theory	4	4	10	15	75	100
4	MPL104T	Cellular and Molecular Pharmacology	Theory	4	4	10	15	75	100
5	MPL105P	Pharmacology Practical I	Practical	6	12	20	30	100	150
6	MEL106S	Seminar	Seminar	4	8	-	-	100	100
			Total	26	36	60	90	500	650

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FACULTY OF PHARMACY									
Program	Master of Pharmacy		Branch/Spec.	Pharmacology					
Semester	I		Version	2.0.0.0					
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards				June 2018		
Subject code	MAT101T		Subject Name	Modern Pharmaceutical Analytical Techniques					
Teaching scheme			Examination scheme						
Credit	4		CE	SE	ES	Total		SE	ES
Hours	4		Marks	10	15	75	100	Duration	1 hr. 3 hr.
Pre-requisites									
Nil									
Scope and Objectives:									
This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are UV, Fluorimeter, NMR, Mass spectrometer, IR, HPLC, GC etc.									
Learning Outcome:									
<ul style="list-style-type: none"> • Student shall be able to understand the theoretical and practical skills of the instruments. • Student shall be able to do analysis of various drugs in single and combination dosage forms. • Student shall be able to design and develop analytical skills. 									
Syllabus- Theory									
Unit	Content								Hrs
1	UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV/Visible Spectroscopy								08
2	Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer								06
3	Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications								08
4	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								05
5	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 ¹³ C NMR. Applications of NMR spectroscopy								07
6	Mass Spectroscopy: Principle, Theory, Instrumentation, 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								05
7	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography								10
8	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 b. X ray Crystallography: Production of X rays, Different X ray diffraction methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.								07
9	Thermal Analysis: Polymer behavior, factors affecting and instrumentation, and working, application of TGA								04
REFERENCES									
1	Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.								
2	Principles of Instrumental Analysis - Douglas 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, 4 th 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, 3 rd Edition, CBS Publishers, New Delhi, 1997.
7	Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series.

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Semester	I		Version	2.0.0.0					
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards	June 2018					
Subject code	MPL102	Subject Name	Advanced Pharmacology - I						
Teaching scheme	Examination scheme								
Credit	4		CE	SE	ES	Total		SE	ES
Hours	4	Marks	10	15	75	100	Duration	1 hr.	3 hr.
Pre-requisites									
Nil									
Scope and Objectives:									
The subject is designed to strengthen the basic knowledge in the field of pharmacology and to impart recent advances in the drugs used for the treatment of various diseases. In addition, this subject helps the students to understand the concepts of drug action and mechanisms involved.									
Learning Outcome:									
Upon completion of this course, students should be able to:									
	<ul style="list-style-type: none"> Discuss the pathophysiology and pharmacotherapy of certain diseases. 								
	<ul style="list-style-type: none"> Explain the mechanism of drug actions at cellular and molecular level 								
	<ul style="list-style-type: none"> Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases 								
Syllabus- Theory									
Unit	Content								Hrs
1	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
2	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). Cotransmission 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
3	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
4	Cardiovascular Pharmacology Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia. Hematinics, coagulants, anticoagulants, fibrinolytics and antiplatelet Drugs								12
5	Autocoid Pharmacology The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins Opioid autocoids. Pharmacology of antihistamines, 5HT antagonists								12
Reference books									
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.

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Semester	I		Version	2.0.0.0					
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards				June 2018		
Subject code	MPL103T	Subject Name	Pharmacological and Toxicological Screening Methods-I						
Teaching scheme		Examination scheme							
Credit	4		CE	SE	ES	Total		SE	ES
Hours	4	Marks	10	15	75	100	Duration	1 hr.	3 hr.
Pre-requisites									
Nil									
Scope and Objectives:									
This subject is designed to impart the knowledge on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development. The subject content helps the student to understand the maintenance of laboratory animals as per the guidelines, basic knowledge of various in-vitro and in-vivo preclinical evaluation processes.									
Learning Outcome:									
Upon completion of this course, students should be able to:									
	<ul style="list-style-type: none"> Appraise the regulations and ethical requirement for the usage of experimental animal. 								
	<ul style="list-style-type: none"> Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental Animals. 								
	<ul style="list-style-type: none"> Describe the various newer screening methods involved in the drug discovery process. 								
	<ul style="list-style-type: none"> Appreciate and correlate the preclinical data to humans. 								
Syllabus- Theory									
Unit	Content								Hrs
1	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
2	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 co-ordination, 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
3	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. Aphrodisiacs and antifertility agents Analgesics, antiinflammatory and antipyretic agents. Gastrointestinal drugs: anti ulcer, anti -emetic, antidiarrheal and laxatives.								12
4	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Cardiovascular Pharmacology: antihypertensives, antiarrhythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents. Anti cancer agents. Hepatoprotective screening methods								12
5	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Immunomodulators, 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

Reference books	
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. Gupta
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)

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Subject code	MPL104T	Subject Name	Cellular and Molecular Pharmacology						
Teaching scheme	Examination scheme								
Credit	4		CE	SE	ES	Total		SE	ES
Hours	4	Marks	10	15	75	100	Duration	1 hr.	3 hr.
Pre-requisites									
Nil									
Scope and Objectives:									
The subject imparts a fundamental knowledge on the structure and functions of cellular components and help to understand the interaction of these components with drugs. This information will further help the student to apply the knowledge in drug discovery process.									
Learning Outcome:									
Upon completion of this course, students should be able to:									
	<ul style="list-style-type: none"> • Explain the receptor signal transduction processes. 								
	<ul style="list-style-type: none"> • Explain the molecular pathways affected by drugs. 								
	<ul style="list-style-type: none"> • Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process. 								
	<ul style="list-style-type: none"> • Demonstrate molecular biology techniques as applicable for pharmacology. 								
Syllabus- Theory									
Unit	Content								Hrs
1	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
2	Cell signaling Intercellular and intracellular signaling pathways. Classification of receptor family and molecular structure ligand gated ion channels; Gprotein 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
3	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
4	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 practic								12
5	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

Reference books	
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 protocols in molecular biology vol I to VI edited by Frederick M.Ausuvel et al.

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Semester	I		Version	2.0.0.0					
Effective from Academic Year	2018-19		Effective for the batches Admitted onwards	June 2018					
Subject code	MPL105P	Subject Name	Pharmacology Practical I						
Teaching scheme	Examination scheme								
Credit	6		CE	SE	ES	Total		SE	ES
Hours	12	Marks	20	30	100	150	Duration	1 hr.	3 hr.
Pre-requisites									
Nil									
Syllabus- Practical									
Unit	Content								
1	PART A: 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								
2	PART B: 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 Bradford/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)								
Reference books									
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 - Douglas 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