Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	MPL101T	**Title of the Course**	Modern Pharmaceutical Analytical Techniques	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	4	0	0	4
Pre-Requisite	B.Pharm	**Co-requisite**	–				
Course Objectives	1.Chemicals and Excipients 2.The analysis of various drugs in single and combination dosage forms 3.Theoretical and practical skills of the instruments						

Course Outcomes	
CO1	Investigate the pharmaceutical substance by absorption and emission techniques.
CO2	Appraise the pharmaceutical substance by nuclear magnetic spectroscopy techniques.
CO3	Examine the mass spectroscopy involved for the pharmaceutical substances.
CO4	Recognize the principle, instrumentation and applications of chromatographic techniques.
CO5	Sketch the principle, instrumentation and applications of electrophoresis and x-ray crystallography.
CO6	Apprehend the fundamentals of immunological assays.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**UV-Visible spectroscopy, IR spectroscopy, Spectroflourimetry , Flame emission spectroscopy and Atomic absorption spectroscopy**	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. 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, Data Interpretation. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	10	1
2	**NMR spectroscopy**	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.	10	2
3	**Mass Spectroscopy**	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.	10	3
4	**Chromatography**	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) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography	10	4
5	**Electrophoresis and X-ray Crystallography**	Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing 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.	10	5
6	**Potentiometry and Thermal Techniques**	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.	10	6

Reference Books:

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

e-Learning Source:

https://www.classcentral.com/course/swayam-spectroscopic-techniques-for-pharmaceutical-and-biopharmaceutical-industries-14301

https://www.sciencedirect.com/science/article/pii/S1878535213001056

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6258797/

https://www.google.co.in/books/edition/Pharmaceutical_Analysis/Ub8wod1CJ50C?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover

https://www.google.co.in/books/edition/Pharmaceutical_Analysis_E_Book/YExgDAAAQBAJ?hl=en&gbpv=1&dq=pharmaceutical+analysis+spectral+chromatography&printsec=frontcover

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	2	2	2	3	2	3	-	3	3	3	-	-	-
CO2	3	3	3	2	3	3	2	3	3	3	3	-	3	3	3	-	-	-
CO3	3	3	3	2	3	3	2	2	3	2	3	-	3	3	3	-	-	-
CO4	3	3	3	3	3	2	2	2	3	3	3	-	3	3	3	-	-	-
CO5	3	3	3	2	3	2	2	2	3	2	3	-	3	3	3	-	-	-
CO6	3	3	3	2	3	2	2	2	3	2	3	-	3	3	3	-	-	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL 102 T	**Title of the Course**	Advance Pharmacology - I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	4	0	0	4
Pre-Requisite	B.Pharm	**Co-requisite**	–				
Course Objectives	1.Discuss the pathophysiology and pharmacotherapy of certain diseases 2.Explain the mechanism of drug actions at cellular and molecular level 3.Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases						

Course Outcomes	
CO1	After studying this subject students will learn regarding the pharmacokinetics and pharmacodynamics of drugs. Students will have the knowledge about the receptor and types of receptors and their examples. Can explain about the effect on efficacy of drugs on changes of absorption, distribution,metabolism and excretion.
CO2	Upon successful completion of this unit the students will have a deep understanding of neurotransmission. Neurohumoral transmission in ANS and CNS and NANC transmission.Apart from this the course provides the detail of various sympathomimetic,sympatholytic,parasympathomimetic and parasympatholytic.
CO3	This unit provide the knowledge about the drugs which act on CNS. Also provide the detail knowledge of pharmacology of CNS acting drugs
CO4	This unit provide the detail knowledge of drugs acting on cardiovascular system particularly antihypertensive,antianginal,antiarrythmic and drugs used in congestive heart failure
CO5	provide detailed knowledge about the different autacoids and their receptors, physiological and pathological role of prostaglandin,histamines,serotonin and dopamine, their agonist and antagonist.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**General Pharmacology**	Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Concepts of linear and non–linear compartment models. Significance of Protein binding. 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	3
2	**Neurotransmission**	General aspects and steps involved in neurotransmission. Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters– Adrenaline and Acetyl choline). Neurohumoral transmission in the central nervous system (Detailed study about neurotransmitters– histamine, serotonin, dopamine, GABA, glutamate and glycine]. 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
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	3
4	**Cardivascular Pharmacology**	Diuretics, antihypertensives, antiischemics, anti–arrhythmics, drugs for heart failure and hyperlipidemia. Hematinics, coagulants , anticoagulants, fibrinolytics and anti– platelet drugs	12	3
5	**Autocoid Pharamcology**	The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins Opioid autocoids. Pharmacology of antihistamines, 5HT antagonists.	12	2

Reference Books:

The Pharmacological Basis of Therapeutics, Goodman and Gillman‘s
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.
Basic and Clinical Pharmacology by B.G Katzung
Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
Graham Smith. Oxford textbook of Clinical Pharmacology.
Avery Drug Treatment
Dipiro Pharmacology, Pathophysiological approach.
Green Pathophysiology for Pharmacists.
Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company
KD.Tripathi. Essentials of Medical Pharmacology.
Modern Pharmacology with Clinical Applications, Craig Charles R. & Stitzel Robert E., Lippincott Publishers.
Clinical Pharmacokinetics & Pharmacodynamics : Concepts and Applications - Malcolm Rowland and Thomas N.Tozer, Wolters Kluwer, Lippincott

Williams & Wilkins Publishers.
Applied biopharmaceutics and Pharmacokinetics, Pharmacodynamics and Drug metabolism for industrial scientists.
Modern Pharmacology, Craig CR. & Stitzel RE, Little Brown & Company.

e-Learning Source:

https://education.baystatehealth.org/sites/default/files/St.%20Jean%20-%20Advanced%20Pharmacology%20for%20nursing.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	2	3	2	2	2	3	2	3	–	3	3	3	–	–	–
CO 2	3	3	3	2	3	3	2	3	3	3	3	–	3	3	3	–	–	–
CO 3	3	3	3	2	3	3	2	2	3	2	3	–	3	3	3	–	–	–
CO 4	3	3	3	3	3	2	2	2	3	3	3	–	3	3	3	–	–	–
CO 5	3	3	3	2	3	2	2	2	3	2	3	–	3	3	3	–	–	–

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL103T	**Title of the Course**	Pharmacological and Toxicological Screening MethodsS - I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**4**	**0**	**0**	**4**
Pre-Requisite	B.Pharm	**Co-requisite**	-				
Course Objectives	1.Upon completion of course the students able to: 2.Appraise the regulation and ethical requirement for the usage of experimental animals 3. describe the various animals used in the drug discovery process and good laboratory practice in the maintenance of animals. 4.Describe the various preclinical evaluations of drugs and recent experimental techniques in the drug discovery and development. 5.Appreciate and correlate preclinical data to humans.						

Course Outcomes	
CO1	Appreciate the knowledge gained on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development.
CO2	Understood the various of laboratory animals and their maintenance as per the guidelines and also describe good laboratory practices in maintenance and handling of experimental animals
CO3	Appraised the regulations and ethical requirements for the usage of experimental animals.
CO4	Learn and describe the various preclinical screening methods (in-vitro and in-vivo) involved in the drug discovery process.
CO5	Learn and describe the various preclinical screening methods (in-vitro and in-vivo) involved in the drug discovery process.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Laboratory animals**	Common lab animals: Description, handling, Applications of different species and strains of animals. Transgenic animals: Production, maintenance and applications Anaesthesia & euthanasia of experimental animals Maintenance and breeding of laboratory animals CPCSEA guidelines to conduct experiments on animals, GLP, Bioassay-Principle, scope and limitations, Bioassay methods.	12	1, 2, 3
2	**Preclinical screening of new substances**	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. CNS Pharmacology: Behavioural and muscular coordination, CNS stimulants, Anxiolytics, antidepressants, antipsychotics, Antiparkonson's drug, Antialzheimer's drug, antiepileptics etc.) Preclinical screening methods of drug acting on ANS.	12	1, 4
3	**Preclinical screening of new substances**	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, Anti-allergics, Aphrodisiacs agents, Antifertility agents, Antiinflammatory agents, Analgesics agents & Antipyretic agents, Gastrointestinal drugs: Anti ulcer, Anti-emetic & Anti-diarrhea, Laxatives.	12	1, 4
4	**Preclinical screening of new substances**	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Drug acting on CVS. Antihypertensive, antiarrythemics, antianginal, antiatherosclerotic, diuretics, antidiabetics, anticancer, hepatoprotectives.	12	1, 4
5	**Preclinical screening of new substances**	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Immunosuppressants, Immunomodulators, 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	4, 5

Reference Books:

Biological standardization by J.H. Burn D.J. Finney and I.G. Goodwin

Screening methods in Pharmacology by Robert Turner. A

Evaluation of drugs activities by Laurence and Bachrach

Methods in Pharmacology by Arnold Schwartz.

Fundamentals of experimental Pharmacology by M.N.Ghosh

Pharmacological experiment on intact preparations by Churchill Livingstone

Drug discovery and Evaluation by Vogel H.G.

Experimental Pharmacology by R.K.Goyal.

Preclinical evaluation of new drugs by S.K. Guta

Handbook of Experimental Pharmacology, SK.Kulkarni

Practical Pharmacology and Clinical Pharmacy, SK.Kulkarni, 3rd Edition.

David R.Gross. Animal Models in Cardiovascular Research, 2nd Edition, Kluwer Academic Publishers, London, UK.

Screening Methods in Pharmacology, Robert A.Turner.

Rodents for Pharmacological Experiments, Dr.Tapan Kumar chatterjee.

Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash (Author)

e-Learning Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3127354/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	2	0	1	3	1	0	0	2	-	3	2	1	-	-	-
CO2	3	3	2	3	0	2	1	1	0	0	3	-	1	1	1	-	-	-
CO3	3	3	2	1	1	0	1	2	0	1	3	-	1	1	1	-	-	-
CO4	3	3	2	1	1	1	2	1	1	0	2	-	3	2	1	-	-	-
CO5	3	3	3	1	1	1	2	1	0	0	3	-	3	2	1	-	-	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL104T	**Title of the Course**	Cellular and Molecular Pharmacology	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**4**	**0**	**0**	**4**
Pre-Requisite	B Pharm	**Co-requisite**	–				
Course Objectives	1.Explain the receptor signal transduction processes. 2 Explain the molecular pathways affected by drugs. 3. Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process. 4. Demonstrate molecular biology techniques as applicable for pharmacology.						

Course Outcomes	
CO1	Explain the receptor signal transduction process. Can able to answer the difference between necrosis and autophagy and understand the pathways of Apoptosis.
CO2	Describe about the receptor classification and their molecular structure. Able to correlate the drug action with the receptor stimulation.
CO3	Analyze the applicability of molecular pharmacology and biomarkers in drug discovery process.
CO4	Describe about immunomodulators. explain the Applications of gene therapy & Proteomics in management of specific disorders.
CO5	Demonstrate molecular biology techniques as applicable for pharmacology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
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	1
2	**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
3	**Principles and applications**	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
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 practice	12	4
5	**Cell culture techniques & Biosimilars**	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

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 porotocols in molecular biology vol I to VI edited by Frederick M.Ausuvel et la.
e-Learning Source:
https://pubmed.ncbi.nlm.nih.gov/9176893/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	1	3	2	3	1	1	1	1	1	-	2	3	3	-	-	-
CO2	2	2	1	3	2	3	1	1	1	1	1	-	2	3	3	-	-	-
CO3	2	3	0	3	2	1	0	0	1	1	1	-	3	2	3	-	-	-
CO4	2	3	0	3	2	0	0	1	1	1	1	-	2	2	3	-	-	-
CO5	2	3	0	3	2	0	0	0	1	1	1	-	2	2	3	-	-	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016 - 2017							
Course Code	MPL105P	**Title of the Course**	Pharmacology Practical I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**0**	**0**	**12**	**6**
Pre-Requisite	B.Pharm	**Co-requisite**	–				
Course Objectives	1. Discuss the pathophysiology pharmacotherapy of certain diseases. 2. Explain the mechanism of drug actions at cellular molecular level. 3. Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of disease.						

Course Outcomes	
CO1	Analyze the pharmacopoeil compounds and their formulatios.
CO2	Execute the quantitative and qualitative analysis.Interpret the result of spectral and chromatographical techniques.
CO3	After studying this subject students will learn regarding the pharmacokinetics and pharmacodynamics of drugs. Students will have the knowledge about the receptor and types of receptors and their examples. Can explain about the effect on efficacy of drugs on changes of absorption, distribution, metabolism and excretion. Upon successful completion of this unit the students will have the deep understanding of neurotransmission. Neurohumoral transmission in ANS and CNS and NANC transmission. Apart from this the course provide the detail of various sympathomimetc,sympatholytic,parasympathomimetc and parasympatholytic
CO4	This unit provides knowledge about the drugs which act on CNS. Also provide the details knowledge of pharmacology of CNS acting drugs. This unit provides the detail knowledge of drugs acting on cardiovascular system particularly antihypertensive, antianginal, antiarrythmic and drugs used in congestive heart failure.
CO5	Provide detail knowledge about the different autocoids and their receptors,physiological and pathological role of prostaglandin,histamine, serotonin and dopamine,their agonist and antagonist.

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Compounds analysis**	Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer	4	1
2	**Component estimation**	Simultaneous estimation of multi component containing formulations by UV spectrophotometry.	4	1
3	**HPLC**	Experiments based on HPLC	4	1
4	**Gas chromatography**	Experiments based on Gas Chromatography.	4	2
5	**Riboflavin estimation**	Estimation of riboflavin/quinine sulphate by fluorimetry.	4	2
6	**Sodium estimation**	Estimation of sodium/potassium by flame photometry.	4	2
7	**Dtrug administration**	Various drug administration.	4	3
8	**Anaesthesia ,Euthanesia**	Techniques of blood sampling, anesthesia and euthanasia of experimental animals	4	3
9	**Battery test**	Functional observation battery tests (modified Irwin test)	4	3
10	**Evaluation CNS stimulant**	Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity	4	3
11	**Drug evaluation**	Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.	4	3
12	**Diuretic evaluation**	Evaluation of diuretic activity	4	3
13	**Drug evaluation**	Evaluation of antiulcer activity by pylorus ligation method.	4	3
14	**Glucose tolerance test**	Oral glucose tolerance test	4	4
15	**DNA isolation**	Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver).	4	4
16.	**RNA isolation**	Isolation of RNA from yeast	4	4
17.	**Protein estimation**	Estimation of proteins by Braford/Lowry's in biological samples	4	4
18	**RNAestimation**	Estimation of RNA/DNA by UV Spectroscopy	4	4
19.	**Gene amplification**	Gene amplification by PCR	4	4
20.	**Protein quantoification**	Protein quantoification western blotting.	4	4
21.	**Assays**	Enzyme based in-vitro assays (MPO,AChEs, α amylase, α glucosidase).	4	4
22	**Assays**	Cell viability assays (MTT/Trypan blue/SRB).	4	4
23	**DNA fragmentation**	DNA fragmentation assay by agarose gel electrophoresis	4	4

24	**.DNA damage**	DNA damage study by Comet assay	4	5
25	**Apoptosis determination**	Apoptosis determination by fluorescent imaging studies	4	5
26.	**Drug data analysis**	Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares	4	5
27	**Enzyme inhibition**	Enzyme inhibition and induction activity	4	5
28	**Drug extraction**	Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)	4	5
29	**Drug extraction**	Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (HPLC)	4	5

Reference Books:

CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines,

Fundamentals of experimental Pharmacology by M.N.Ghosh

Handbook of Experimental Pharmacology by S.K. Kulkarni.

Drug discovery and Evaluation by Vogel H.G.

Spectrometric Identification of Organic compounds – Robert M Silverstein,

Principles of Instrumental Analysis – Doglas A Skoog, F. James Holler, Timothy A. Nieman,

Vogel's Text book of quantitative chemical analysis – Jeffery, Basset, Mendham, Denney,

Basic Cell Culture protocols by Cheril D. Helgason and Cindy L.Mille

Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)

Animal Cell Culture: A Practical Approach by John R. Masters (Editor)

Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi(Author), Ajay Prakash (Author) Jaypee brothers' medical publishers Pvt. Ltd

e-Learning Source:

Animal simulation Ex- Pharm

https://www.pdfdrive.com/drug-discovery-and-evaluation-e33529234.html

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3	2	1	1	1	1	-	3	3	3	-	-	-
CO2	3	3	3	3	2	2	2	2	1	1	1	-	3	3	3	-	-	-
CO3	3	3	3	3	3	2	2	3	1	1	1	-	3	3	3	-	-	-
CO4	3	3	3	3	2	2	2	2	1	1	1	-	3	3	3	-	-	-
CO5	3	3	3	3	3	3	2	2	2	1	1	-	3	3	3	-	-	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL201T	**Title of the Course**	Advanced Pharmacology-II	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**4**	**0**	**0**	**10**
Pre-Requisite		**Co-requisite**					
Course Objectives	1. To impart the detailed concept of Pharmacology and toxicology, Advanced pharmacology along with clinical applications of drugs. 2. The course provide basic knowledge of toxicity and its management and principles of bioassay of different drugs 3. To provide skills for selection of experimental models in order to screen different pharmacological agents along with several regulatory ethical guidelines concerned with it. 4. The course will emphasize on molecular signalling concepts of drugs with special attention given to endogenous bioactive molecules, and their pharmacokinetic and pharmacodynamic profile. 5. To provide a strong foundation regarding chronopharmacology, immunopharmacology and gene-based Pharmacology which would be a framework for future pharmacological approach to a specific problem in the field of drug development. 6. This course is designed to provide basic understanding in the principles of clinical Pharmacology emphasizing on several regulatory and ethical guidelines concerned with clinical Pharmacological experiments.						

Course Outcomes	
CO1	Analyze the different types of endocrine hormones and their role, Molecular & Cellular MOA. Further can understand the deficiency and excess release related endocrine disorders and their therapy.
CO2	Able to explain the MOA and the resistance of antimicrobial agents including antivirals and Anti TB in cellular and molecular level
CO3	Demonstrate the safe applications of Antiprotozoal & Anticancer drugs in clinical and it also explain about the role of inflammatory mediators role in Asthma, Hypersensitivity reaction.
CO4	They can co-relate the pathophysiology behind Gastric ulcer and their therapy with conventional drugs along with new therapeutic approaches.
CO5	Correlate about free radical generation with diseased conditions and their therapy with antioxidants, they can also explain about chronotherapy and Recent Advances in treatment of neurodegenerative disease, Cancer, Diabetes Mellitus

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**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
2	**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
3	**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
4	**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
5	**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

Reference Books:

The Pharmacological basis of therapeutics- Goodman and Gill man's

Principles of Pharmacology. The Pathophysiologic basis of drug therapy by David E Golan et al.

Basic and Clinical Pharmacology by B.G -Katzung

Pharmacology by H.P. Rang and M.M. Dale.

Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.

Text book of Therapeutics, drug and disease management by E T. Herfindal and Gourley.

Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.

Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists

Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)

A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company.

KD.Tripathi. Essentials of Medical Pharmacology.

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

e-Learning Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4888811/
https://drive.google.com/file/d/1xZUXCeoMIvKUDLgplZPnPl8NplnaIVyK/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1AsToYm8V_eJs-QhFyORilu4x9snQwYmU/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1GV4XAflBasfUgO68tBLlEM5CofZvKEs0/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1xhWz7Biu5F0Pl4DlwfMRnTKxvsTicJ0c/view?usp=drive_web&authuser=0
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6278270/
https://drive.google.com/file/d/1GV4XAflBasfUgO68tBLlEM5CofZvKEs0/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1VSvRcGydpXgW0unslqxoUpoig9O-VdsP/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1bmNQZkN38cHHXqNjBnyCGDImTUs81stp/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1VSvRcGydpXgW0unslqxoUpoig9O-VdsP/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1kKeE_ycwo0jrkL2xHOMuDdh5Y9lf87cK/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1yowFP4zAxUe6jJiSMl01C6DYa5zhMvYY/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1HMhLQL18qsZQZhUB2WsdGU8_zjTSA9Yr/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1kKeE_ycwo0jrkL2xHOMuDdh5Y9lf87cK/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1SVYepkRVdIi8AzXlquQW_A5O04YGq2fM/view?usp=drive_web&authuser=0
https://drive.google.com/file/d/1yowFP4zAxUe6jJiSMl01C6DYa5zhMvYY/view?usp=drive_web&authuser=0

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	1	3	2	3	1	1	1	1	1	-	2	3	2	-	-	-
CO2	2	2	1	3	2	3	1	1	1	1	1	-	2	3	2	-	-	-
CO3	2	3	0	3	2	1	0	0	1	1	1	-	3	2	3	-	-	-
CO4	2	3	0	3	2	0	0	1	1	1	1	-	2	2	2	-	-	-
CO5	2	3	0	3	2	0	0	0	1	1	1	-	2	2	2	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL 202 T	**Title of the Course**	Pharmacological and Toxicological Screening Methods - II	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**4**	**0**	**0**	**4**
Pre-Requisite	B.Pharm	**Co-requisite**	–				
Course Objectives	1. Explain the various types of toxicity studies. 2. Appreciate the importance of ethical and regulatory requirement for toxicity studies. 3. Demonstrate the practical skills require to conduct toxicity studies.						

Course Outcomes	
CO1	Explore various types of toxicological studies and its regulatory guidelines including OECD principle of good laboratory practice.
CO2	Explicate OECD principle of good laboratory practice.
CO3	Design, conduct and analyze various screening methods employed for conducting toxicological studies in drug discovery and development.
CO4	Explain and design protocol for safety pharmacology & toxicokinetics studies.
CO5	Utilized various Alternative methods for animal toxicity testing employed in drug discovery and development.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Toxicology**	Basic definition and types of toxicology (general, mechanistic, regulatory and descriptive), OECD,ICH & EPA guidelines for conducting toxicity studies, GLP	12	1, 2
2	**Toxicity studies**	Acute, sub-acute and chronic oral, Demal & inhalational toxicity studies as per OECD guidelines. Skin sensitization studies, Acute eye irritation studies	12	3
3	**Reproductive toxicity studies**	Male Reproductive toxicology 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
4	**IND**	List of studies needed for IND submission , Safety pharmacology studies, Tier-1 & Tier-2,	12	4
5	**Toxicokinetics**	Toxicokinetics In Preclinical studies, saturation kinetics, Importance, Applications, Alternative methods to animal toxicity study.	12	5

Reference Books:

Principles of Toxicology by Karen E. Stine, Thomas M. brown.

OECD guidelines

Animal models in Toxicology by Lower and Bariyan.

Drug from discovery to approval by Rick NG.

e-Learning Source:

https://education.baystatehealth.org/sites/default/files/St.%20Jean%20-%20Advanced%20Pharmacology%20for%20nursing.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	1	3	2	3	1	1	1	1	1	-	2	3	2	-	-	-
CO2	2	2	1	3	2	3	1	1	1	1	1	-	2	3	2	-	-	-
CO3	2	3	0	3	2	1	0	0	1	1	1	-	3	2	2	-	-	-
CO4	2	3	0	3	2	0	0	1	1	1	1	-	2	2	2	-	-	-
CO5	2	3	0	3	2	0	0	0	1	1	1	-	2	2	2	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL203T	**Title of the Course**	Principles of Drug Discovery	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	B.Pharm.	**Co-requisite**	–				
Course Objectives	1. Explain the various stages of drug discovery. 2. Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery. 3. Explain various targets for drug discovery. 4. Explain various lead seeking methods and lead optimization. 5. Appreciate the importance of the role of computer aided drug design in drug discovery						

Course Outcomes	
CO1	Explain the various stages of drug discovery
CO2	Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery
CO3	Explain various targets for drug discovery
CO4	Explain various lead seeking method and lead optimization
CO5	Appreciate the importance of the role of computer aided drug design in drug discovery

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Drug Discovery Process**	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, 2, 3, 4, 5
2	**Lead identification and in silico techniques**	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	1, 2, 3, 4, 5
3	**Rational drug design**	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	1, 2, 3, 4, 5
4	**Docking**	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	1, 2, 3, 4, 5
5	**QSAR**	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	1, 2, 3, 4, 5

Reference Books:

Mouldy Sioud. Target Discovery and Validation Reviews and Protocols: Volume 2 Emerging Molecular Targetsand Treatment Options. 2007 Humana Press Inc.

Darryl León. Scott MarkelIn. Silico Technologies in Drug Target Identification and Validation. 2006 by Taylor and Francis Group, LLC.

Johanna K. DiStefano. Disease Gene Identification. Methods and Protocols. Springer New York Dordrecht Heidelberg London.

Hugo Kubiny. QSAR: Hansch Analysis and Related Approaches. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH.

Klaus Gubernator, Hans-Joachim Böhm. Structure-Based Ligand Design. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH.

Abby L. Parrill. M. Rami Reddy. Rational Drug Design. Novel Methodology and Practical Applications. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.

J. Rick Turner. New drug development design methodology and analysis. John Wiley & Sons, Inc., New Jersey.

e-Learning Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3058157/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	1	3	2	2	1	3	3	3	–	3	2	3	–	–	–

CO 2	3	3	3	2	3	2	2	2	3	3	3	–	3	2	3	–	–	–
CO 3	3	3	3	1	3	2	2	1	3	3	3	–	3	2	3	–	–	–
CO 4	3	3	3	2	3	2	2	1	3	3	3	–	3	2	3	–	–	–
CO 5	3	3	3	2	3	2	2	2	3	3	3	–	3	2	3	–	–	–
CO 6	3	3	3	1	3	2	2	1	3	3	3	–	3	2	3	–	–	–

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: **2016-2017**							
Course Code	MPL 204 T	Title of the Course	Clinical Research and Pharmacovigilance	L	T	P	C
Year	I	Semester	II	4	0	0	4
Pre-Requisite	B Pharm	Co-requisite	–-				
Course Objectives	1.Different types of natural compounds and their chemistry and medicinal importance 2.The importance of natural compounds as lead molecules for new drug discovery 3.The concept of rDNA technology tool for new drug discovery 4.General methods of structural elucidation of compounds of natural origin 5.Isolation, purification and characterization of simple chemical constituents from natural source						

Course Outcomes	
CO1	After studying this subject, students will learn regarding the regulatory requirement of conducting clinical trial.
CO2	After studying this subject, students can demonstrate the types of clinical trial and designs, the responsibility of core team member involved in clinical trial.
CO3	After studying this subject, students will learn Clinical Trial Documentation and ADR assessment and reporting.
CO4	After studying this subject, students can explain the basic aspects, terminologies and establishment of pharmacovigilance.
CO5	After studying this subject, students will know the principles of pharmacovigilance.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**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	3
2	**Clinical Trials: Types and Design**	Experimental Study– 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	3
3	**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
4	**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	2
5	**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 evaluating medication safety data. Pharmacoepidemiology, pharmacoeconomics, safety pharmacology	12	3

Reference Books:

Central Drugs Standard Control Organization– Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health;2001.

.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.

.Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.

Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

e-Learning Source:

https://www.ncbi.nlm.nih.gov/books/NBK220717/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	2	3	3	3	3	3	3	2	3	3	3	-	3	2	3	-	–	–
CO 2	3	3	3	3	3	2	2	3	2	2	2	-	2	3	2	-	–	–
CO 3	3	2	2	2	2	2	3	1	3	3	3	-	3	3	3	-	-	–
CO 4	3	3	3	3	3	2	2	2	3	2	2	–	3	3	2	–	-	–
CO 5	3	2	3	3	1	1	3	1	2	3	3	–	2	2	3	–	-	–

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	MPL205P	**Title of the Course**	Pharmacology Practical- I	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**0**	**0**	**12**	**6**
Pre-Requisite	B.Pharm	**Co-requisite**	–				
Course Objectives	1. Discuss the pathophysiology pharmacotherapy of certain diseases. 2. Explain the mechanism of drug actions at cellular molecular level. 3. Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of disease.						

Course Outcomes	
CO1	Able to explain the MOA and the resistance of antimicrobial agents including antivirals and Anti TB in cellular and molecular level
CO2	They can co-relate the pathophysiology behind Gastric ulcer and their therapy with conventional drugs along with new therapeutic approaches.
CO3	Analyze the different types of endocrine hormones and their role, Molecular & Cellular MOA. Further can understand the deficiency and excess release related endocrine disorders and their therapy.
CO4	Demonstrate the safe applications of Antiprotozoal & Anticancer drugs in clinical and it also explain about the role
CO5	Correlate about free radical generation with diseased conditions and their therapy with antioxidants, they can also explain about chronotherapy and Recent Advances in treatment of neurodegenerative disease, Cancer, Diabetes Mellitus of inflammatory mediators role in Asthma, Hypersensitivity reaction.

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	**Drug response curve**	To record the DRC of agonist using suitable isolated tissues preparation.	4	1
2	**Drug effect**	To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation.	4	1
3	**Matching bioassay**	To determine the strength of unknown sample by matching bioassay by using suitable tissue preparation.	4	1
4	**Interpolation bioassay**	To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation	4	1
5	**Bracketing bioassay**	To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation	4	1
6	**Multiple point bioassay**	To determine the strength of unknown sample by multiple point bioassay by using suitable tissue preparation.	4	1
7	**PA2**	Estimation of PA_2 values of various antagonists using suitable isolated tissue preparations.	4	1
8	**Drug effect**	To study the effects of various drugs on isolated heart preparations	4	2
9	**B.P. recording**	Recording of rat BP, heart rate and ECG.	4	2
10	**ECG recording**	Recording of rat ECG	4	2
11	**Drug absorption**	Drug absorption studies by averted rat ileum preparation.	4	2
12	**Toxicity studies**	Acute oral toxicity studies as per OECD guidelines.	4	2
13	**Toxicity studies**	Acute dermal toxicity studies as per OECD guidelines.	4	2
14	**Dose toxicity**	Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies.	4	2
15	**Clinical trial**	Protocol design for clinical trial.(3 Nos.)	4	3
16.	**ADR design**	Design of ADR monitoring protocol.	4	3
17.	**Mutagenicity design**	Drug mutagenicity study using mice bone-marrow chromosomal aberration test.	4	3
18	**Docking**	In-silico docking studies. (2 Nos.)	4	3
19.	**Pharmacophore screening**	In-silico pharmacophore based screening.	4	3
20.	**In silico study**	In-silico QSAR	4	3
21.	**ADRreporting**	ADR reporting	4	3

Reference:

Handbook of Experimental Pharmacology, S.K Kulkarni

e-Learning Source

Animal simulation Ex- Pharm

https://www.chem.purdue.edu/courses/chm224/Lab-Experiments/Exp9_mod.pdf

Integral University, Lucknow

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	3	2	3	3	1	3	-	-	-	-	-	-	-
CO2	3	2	3	3	3	3	2	2	1	1	3	-	-	-	-	-	-	-
CO3	3	3	1	3	1	2	2	1	1	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	2	2	2	3	2	2	3	-	-	-	-	-	-	-
CO5	3	3	3	3	2	2	1	2	2	1	3	-	-	-	-	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2017-2018							
Course Code	MRM 301 T	**Title of the Course**	Research Methodology & Biostatistics	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	4	0	0	4
Pre-Requisite		**Co-requisite**					
Course Objectives	1. Explain the basic requirements for designing the research project. 2. Demonstrate the types of statistical methods. 3. Explain the CPCSEA guidelines for keeping the laboratory animals. 4. Explain the different ethical principles for conducting the clinical trials. 5. Explain the principles declaration of Helsinki and ICG guidelines						

Course Outcomes	
CO1	After studying this subject, students will learn regarding the strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.
CO2	Students can demonstrate different statistical methods for calculation of data such as t test, ANOVA, wilcoxan rank tests etc.
CO3	Students will learn about history, values in medical ethics, autonomy, beneficence, non–maleficence, double effect, conflicts between autonomy and beneficence/non–maleficence, euthanasia, informed consent, confidentiality etc.
CO4	After studying this subject, students can explain the CPCSEA guidelines for laboratory animal facility.
CO5	After studying this subject, students will know the Declaration of Helsinki: History, introduction, basic principles for all medical research,

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	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.	12	3
2	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.	12	3
3	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.	12	3
4	CPCSEA guidelines for laboratory animal facility:	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.	12	2

5	Declaration of Helsinki:	History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	12	3

Reference Books:

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.

e-Learning Source:

https://drive.google.com/drive/folders/1W4b4NRhqBQWMC14vsBNZcdc2LWFFmcrd?usp=share_link

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	2	3	3	3	3	3	3	2	3	3	3	-	3	2	3	-	-	
CO 2	3	3	3	3	3	2	2	3	2	2	2	-	2	3	3	-	-	
CO 3	3	2	2	2	2	2	3	1	3	3	3	-	3	3	3	-	-	
CO 4	3	3	3	3	3	2	2	2	3	2	2	-	3	3	3	-	-	
CO 5	3	2	3	3	1	1	3	1	2	3	3	-	2	2	3	-	-	

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Name & Sign of Program Coordinator	Sign & Seal of HoD