

MASTER OF PHARMACY (M. PHARM.): PHARMACOLOGY

(Two year post graduate degree course)

CREDIT BASED SEMESTER SYSTEM

SCHEME OF TEACHING, EXAMINATION AND SYLLABUS

M. Pharm. I Semester

w.e.f. ACADEMIC SESSION 2013-2014



RKDF University

Bhopal (MP) 462033, INDIA



M. Pharm : Pharmacology

Scheme of Teaching and Examination

M. Pharm I Semester Scheme									
Subject Code	Name of Subject	Teaching scheme (hrs/week)		Credits		Examination Scheme			
		T	P	T	P	T		P	
						Ext	Int	Ext	Int
MPMI101[T]	Modern Instrumental Methods	4	-	4	-	70	30	-	-
MPMI101[P]	Modern Instrumental Methods	-	6	-	3	-	-	60	40
MPCL102[T]	General Pharmacology, Pathophysiology and Therapeutics	4	-	4	-	70	30	-	-
MPCL102[P]	General Pharmacology, Pathobiology and Therapeutics	-	6	-	3	-	-	60	40
MPPD103[T]	Product development and quality assurance	4	-	4	-	70	30	-	-
MPPD103[P]	Product development and quality assurance	-	6	-	3	-	-	60	40
MPCL104[P]	Clinical Pharmacology	4	-	4	-	70	30	-	-
		16	18	16	09	400		300	
Total		34 hrs/week		25		700			

T- Theory, P- Practical, Ext- External, Int- Internal

Theory: 1 Theory hour = 1 Credit

Practical: 2 Practical hour = 1 Credit

Internal assessment (Theory): Best one out of two sessional per semester.

Internal assessment (Practical) Based on day to day performance including attendance, *viva-voce* and laboratory record.



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	60 Hrs [Theory]
Subject Code	MPMI101[T]	Subject Name	Modern Instrumental Methods

Syllabus

Ultraviolet – Visible spectrometry: Introduction, the nature of electronic excitation, the origin of UV band structure, principle of absorption spectroscopy, chromophore- $\sigma \rightarrow \sigma^*$, $\eta \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$ transitions, basics of instrumentation techniques, pharmaceutical applications. Woodward - Fisher rule for calculation of λ_{max} . Introduction to optical rotatory dispersion and circular dichroism. Derivative spectroscopy.

Fourier Transform Infrared Spectroscopy: Introduction, the infrared absorption process, the modes of vibrations, stretching and bending, bond properties and absorption trends, basics of instrumentation techniques, pharmaceutical applications. Interpretation of Infrared spectra.

Nuclear Magnetic Resonance Spectroscopy: High resolution ^1H and ^{13}C NMR spectroscopy, theoretical calculation of chemical shift of various carbon atoms, techniques used for finding out types of carbon attached proton test (APT) distortion less energy polarization transfer (DEPT), homonuclear and heteronuclear correlation spectroscopy. Different 1D and 2D NMR correlation spectrophotometric techniques used as COSy, NOESY, HETCOR, INADEQUATE, HSBC, HMQC, etc. Use of this technique in determination of absolute configuration.

Spectrometry of other important nuclei: Introduction to ^{15}N , ^{19}F , ^{31}P , basic concepts.

Mass spectrometry: Basic principle and theory involved, basics of instrumentation techniques, tandem mass spectrometry and its applications.

HPLC: Instrumentation covering detailed discussion of pumps, injector system, columns and detectors. Analytical method development, validation as per ICH guidelines and troubleshooting. Quantification methods used in HPLC. Ultra pressure liquid chromatography.

HPTLC: Basic instrumentation and its calibration. Analytical method development and its validation as per ICH guidelines. Quantification using HPTLC.

Thermoanalytical techniques: Differential Scanning Calorimetry (DSC), Thermogravimetry (TG), Thermo mechanical analysis (TMA): Principles instrumentation and applications (including interpretation of data) in pharmacy.



Radio analytical techniques used in pharmaceuticals: Isotopic dilution methods, Radioimmunoassay, ELISA etc.

Microscopy: Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), cryomicroscopy, Atomic force microscopy (AFM), confocal microscopy.

Statistics : Collection and classification of experimental data and its statistical treatment, Probability- definition and laws of probability, regression and correlation, method of least squares, correlation coefficient and multiple regression, Test of significance and t-test, statistical quality control, process control, control chart, acceptance sampling plans.

Suggested Readings/Books:

1. Instrumental methods of chemical analysis by chatwal. K, Anand, 5th edition.
2. Organic spectroscopy by Y.R.Sharma.
3. Text book of pharmaceutical analysis by S.Ravishankar.
4. Spectrometric identification of Organic Compounds, Robert. M. Silverstein et al, 7th Edition, 1981.
5. Principles of Instrumental Analysis by Douglas A. Skoog, James, J. Leary, 4th Edition.
6. Pharmaceutical Analysis – Modern Methods – Part A, Part B, James W. Munson –2001.
7. Practical Pharmaceutical Chemistry, Part two, A. H. Beckett & J. B. Stenlake – 4th Edition.
8. Instrumental Methods of Chemical Analysis – B. K. Sharma - 9th Edition.
9. Chromatography – P. D. Sethi, Dilip Charegaonkar, 2nd Edition.
10. Spectroscopy of Organic Compounds by P. S. Kalsi.
11. Organic Spectroscopy by William Kemp
12. Pharmaceutical drug analysis by Ashouthosh Kar
13. Quantitative analysis of Drugs and Formulations by Sethi



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	120 Hrs [Practical]
Subject Code	MPMI101[P]	Subject Name	Modern Instrumental Methods

Practicals:

Practical exercises based on the topic mentioned in theory syllabus.



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	60 Hrs [Theory]
Subject Code	MPCL102[T]	Subject Name	General Pharmacology, Pathophysiology and Therapeutics

Syllabus

Introduction to pharmacology: ADME and factors influencing disease conditions.

Pathophysiology and drug therapy of neurological and psychiatric disorders: Alzheimer, anxiety, depression, epilepsy, huntington, parkinsonism, schizophrenia etc.

Pathophysiology and drug therapy of cardiovascular disorders: Angina, arrhythmia, congestive heart failure, hyperlipoproteinemias, hypertension etc.

Drug therapy of endocrine disorders: Disorders of thyroid gland, adrenal gland, diabetes, gonadal hormones, contraceptives etc.

Pathophysiology and drug therapy of pain and inflammation: Osteoarthritis, gout etc.

Pathophysiology and drug therapy of gastrointestinal disorders: Peptic ulcer, inflammatory bowel disease etc.

Pathophysiology and drug therapy of respiratory disorders: Asthma, tuberculosis, pneumonia etc.

Chemotherapy with antimicrobial and antiparasitic agents: Sulfonamides, quinolones, chloramphenicol, aminoglycosides. tetracyclines, penicillins, cephalosporins, antiviral, antifungal, helminthiasis, malaria, leprosy, antineoplastic agents etc.

Multi-drug resistance and its mechanism: Drug resistant tuberculosis, malaria etc.

Design of experiments: Objectives, strategies, experimental design, basic principles replication, randomization, blocking, meaning and purpose of research design, types of research design, criteria of a good research design.

Guidelines for design of experiments: Simple comparative experiments, basic statistical concepts, random variable, sample mean and variance, degrees of freedom, standard and normal distribution, statistical hypothesis, t-test, P-value, confidence intervals, paired and unpaired comparisons.

Suggested Readings/Books:

1. Brunton LL, Lazo JS and Parker KL, Eds. Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill, New York. Latest Edition.



2. Katzung BG. Basic and Clinical Pharmacology. Lange/Mc Graw-Hill Medical Publications, New York. Latest Edition.
3. Kalant H and Roschlan WHE. Principles of Medical Pharmacology. Oxford University Press, New York. Latest Edition.
4. Rang HP, Dale MM and Ritter JM. Pharmacology. Churchill Livingstone, New York. Latest Edition.
5. Sharma HL and Sharma KK. Principles of Pharmacology. Paras Publisher, Delhi. Latest Edition.
6. Shargel L, Mutnick AH, Souney PF and Swanson LN. Comprehensive Pharmacy Review. Wolters Kluwer Health / Lippincott William & Wilkins, New Delhi. Latest Edition.
7. Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG and Posey LM, Eds. Pharmacotherapy: A Pathophysiologic Approach. McGraw-Hill, New York. Latest Edition.



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	120 Hrs [Practical]
Subject Code	MPCL102[P]	Subject Name	General Pharmacology, Pathophysiology and Therapeutics

Practicals:

Practical exercises based on the topic mentioned in theory syllabus.



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	60 Hrs [Theory]
Subject Code	MPPD103[T]	Subject Name	Product development and quality assurance

Syllabus

Preformulation Studies: Introduction, goals of preformulation, physicochemical properties, criteria for selection of drug and excipients, compatibility tests. Partition coefficient, Solid state pharmaceuticals.

Optimization: Definition, need, advantages, Meaning of general terms involved in optimization process. Classification of optimization methods.

Brief description and importance of experimental design with special reference to designs adequate for large number of variables. Introduction of correlation & regression analysis & mathematical model, contour plots. Basic understanding with at least one example of following optimization techniques:-Simplex method, langarengian method, EVOP, Grid search method.

Solubility and Solubilization: Development of theoretical relationships of prognostic relevance, theory and techniques of solubilization of drugs including surfactant systems, co-solvents, solid state manipulations, complexation and chemical modifications, methods of solubility enhancement, factors influencing solubility.

Designing of Pharmaceuticals: Tablet formulation, Special tablets, preparation of components for compression, characterization of granulation, coating of tablets, evaluation of tablets, Equipments and processing problems in tablet.

Liquids: Formulation considerations of oral liquids, suspensions, emulsions, development of various products. Formulation consideration of parenteral, ophthalmic, depot products, large volume and small volume parenterals, environmental control and quality assurance in parenterals.

Disperse systems: Molecular dispersion, coarse dispersions- Physical stability of suspensions and emulsion, role of zeta potential in stability of coarse dispersions, theory of emulsification, micro and multiple emulsions, rheology of suspensions and emulsions. Drug kinetics in coarse disperse systems, drug diffusion in coarse dispersion systems.

Topical and rectal formulations and evaluation.



Introduction to Controlled and Novel Drug Delivery Systems: Sustained release dosage forms, Prodrug concept, nanoparticles, liposomes, resealed erythrocytes, transdermal and other novel drug delivery systems.

Pilot-plant and scale-up techniques.

In vitro and In-Vivo evaluation techniques, product formulation and cGMP

Validation: Concepts in validation, prospective, concurrent, retrospective validation & revalidation, validation of manufacturing, analytical and process validation and its application.

Basic concepts of quality control and quality assurance systems, source and control of quality variation of raw materials: containers, closures, personnel, environmental etc.

In-process quality tests, IPQC problems in Pharmaceutical industries. ICH guidelines.

Sampling Plans, Sampling and Characteristic Curves.

Master formula generation and maintenance, standard operating procedure (SOP) for different dosage forms.

Suggested Readings/Books:

1. Lachmann, L., Lieberman, H.A. & Kanig, J.I.: The Theory and Practice of Industrial pharmacy. Lea and Fibiger, Philadelphia.
2. Banker, G.S. & Rhodes, C.T. : Modern Pharmaceutics, Marcel Dekker Inc. New York and Basel.
3. Turco, S. & King R.E. : Sterile Dosage Forms, Lea and Febiger, Philadelphia.
4. Bean, H.S., Backett, A.H. & Carless, J.E: Advances in Pharmaceutical Sciences, Academic Press, London and Newyork.
5. Jain, N.K.: Controlled and Novel Drug Delivery, CBS, Delhi.
6. Robinson, J.R. & Lee, V.H.L.: Controlled Drug Delivery, Marcel Dekker, New York and Basel.
7. Chien, Y.W.: Novel Drug Delivery Systems, Marcel Dekker, New York and Basel.
8. Jain N. K. Pharmaceutical Product Development, CBS Publisher, Delhi



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	120 Hrs [Practical]
Subject Code	MPPD103[P]	Subject Name	Product development and quality assurance

Practicals:

Practical exercises based on the topic mentioned in theory syllabus.



Course	M. Pharm	Semester	First
Branch	Pharmacology	Duration	60 Hrs[Theory]
Subject Code	MPCL104[T]	Subject Name	Clinical Pharmacology

Syllabus

Introduction to Clinical Pharmacology : Definition, scope and development of clinical pharmacology, role of pharmacist in healthcare system, prescription monitoring and rational use of drugs, essential drugs and national drug policy, pharmacoepidemiology, pharmacovigilance, patient counselling, medication errors and drug information systems.

Concepts of pharmaceutical care and its implementation: Plan, components and challenges, communication and behavioural skills in clinical practice.

Drug Therapy in Specialized Patient Populations:

Neonates: Special childhood diseases and their management, national immunization programmes, relevant pediatric management issues as dosages adjustment, pharmacokinetics of development stage and compliance.

Geriatrics: Pharmaceutical care plan based on age related physiological and pharmacokinetic / pharmacodynamic changes, compliance related issues.

Pregnancy and Lactation: Guidelines and principles of drug therapy during pregnancy and lactation. Management of hypertension, diabetes, epilepsy etc. during pregnancy.

Clinical Trials:

Requirements of clinical trials, Helsinki declaration, ethical and legal issues in clinical trials.

Design (placebo, multicentre clinical trials, randomization, blinding) and different phases of clinical trials (Phase 1 to 4), principles of controlled clinical trials.

Protocol designing, CRF, patient informed consent, patient enrolment, inclusion and exclusion criteria, withdrawals and drop out, run-in period.

Clinical trial team, monitoring of clinical trial, report preparation, deviations in clinical trials.

Clinical data management.

Adverse drug reactions: Incidence, importance, surveillance and their monitoring, WHO ADR reporting programmes in India and drug interactions.



National and international guidelines and drug regulations and recent developments in clinical research: Good clinical practice, ICH guidelines, FDA/EMA documentation preparation.

Telemedicine: History and advances in telemedicine, benefits and limitations of telemedicine. Regulations for laboratory animal care and ethical requirements. CPCSEA guidelines for performing experiments on animals. Alternatives to animal studies.

Suggested Readings/Books:

1. Bennett PN and Brown MJ. Clinical Pharmacology. Churchill Livingstone, Edinburgh. Latest Edition.
2. Walker R and Edwards C. Clinical Pharmacy and Therapeutics. Churchill Livingstone, London. Latest Edition.
3. Shargel L, Mutnick AH, Souney PF and Swanson LN. Comprehensive Pharmacy Review. Wolters Kluwer Health / Lippincott William & Wilkins, New Delhi. Latest Edition.
4. Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG and Posey LM, Eds. Pharmacotherapy: A Pathophysiologic Approach. McGraw-Hill, New York. Latest Edition.
5. Laurence DR. Clinical Pharmacology. Churchill Livingstone, London. Latest Edition.



RKDF University

MASTER OF PHARMACY (M. PHARM.): PHARMACOLOGY

(Two year post graduate degree course)

CREDIT BASED SEMESTER SYSTEM

SCHEME OF TEACHING, EXAMINATION AND SYLLABUS

M. Pharm. II Semester

w.e.f. ACADEMIC SESSION 2013-2014



RKDF University

Bhopal (MP) 462033, INDIA



M. Pharm : Pharmacology

Scheme of Teaching and Examination

M. Pharm II Semester Scheme									
Subject Code	Name of Subject	Teaching scheme		Credits		Examination Scheme			
		T	P	T	P	T		P	
						Ext	Int	Ext	Int
MPCL201[T]	Recent Advances in Pharmacology	4	-	4	-	70	30	-	-
MPCL202[T]	Molecular Pharmacology	4	-	4	-	70	30	-	-
MPCL203[T]	Drug discovery and Toxicology	4	-	4	-	70	30	-	-
MPCL204[T]	Experimental Pharmacological Techniques	4	-	4	-	70	30	-	-
MPCL205[P]	Pharmacology Practical- II	-	18	-	09	-	-	60	40
		16	18	16	09	400		100	
Total		34 hrs/week		25		500			

T- Theory, P- Practical, Ext- External, Int- Internal

Theory: 1 Theory hour = 1 Credit

Practical: 2 Practical hour = 1 Credit

Internal assessment (Theory): Best one out of two sessional per semester.

Internal assessment (Practical) Based on day to day performance including attendance, *viva-voce* and laboratory record.



Course	M. Pharm	Semester	Second
Branch	Pharmacology	Duration	60 Hrs[Theory]
Subject Code	MPCL201[T]	Subject Name	Recent Advances in Pharmacology

Syllabus

Receptor pharmacology: Classification and structure of receptors, dopamine receptors, serotonin receptors, endothelin receptors, GABA-benzodiazepine receptors, excitatory amino acid receptors, sigma receptors, adenosine and cannabinoids.

Neurotrophins: Nerve growth factor, brain derived neurotrophic factor, neurotrophin 3 & 4, neurotrophin receptors and their involvement in depression and neurodegenerative disorders.

Neurotransporters: Plasma membrane neurotransmitter transporters (Na⁺/Cl⁻ dependent neurotransmitter transporters, Na⁺/K⁺ dependent glutamate transporters), vesicular neurotransmitter transporters (monoamine transporters and acetylcholine transporters).

Apoptosis: Necrosis, apoptotic cell death cascade, implications in inflammation and asthma, beta cell apoptosis in diabetes.

Cytokines: Classification, cytokines receptors, chemokine receptors and their role in CNS and CVS disorders.

Nanomedicine: Principle, applications, nanodevices and nanoparticles in medicine.

Probiotics: Pre and probiotics, mechanism of action, therapeutic applications, ethical issues & safety considerations.

Therapeutic potential of purinergic signaling and xanthine oxidase inhibitors in diverse pathological conditions.

Mitochondrial dysfunction linked neurological diseases, mitochondrial mediated cell death in diabetes.

Newer antibiotics and chemotherapeutic agents, biochemical mechanisms of multi drug resistance in chemotherapy, strategies to reverse MDR.

Endothelium derived vascular substances (NO, endothelins) and their modulators, pharmacology of atrial peptides, reactive oxygen intermediates, antioxidants and their therapeutic implications.

Pharmacology of leptin and its receptors, β_3 adrenoceptor.

Suggested Readings/Books:

1. Annual Reviews of Pharmacology and Toxicology.



2. Pharmacological Reviews.
3. Trends in Pharmacological Sciences.
4. Trends in Neurosciences.
5. Journal of Pharmacology and Experimental Therapeutics.



Course	M. Pharm	Semester	Second
Branch	Pharmacology	Duration	60 Hrs[Theory]
Subject Code	MPCL202[T]	Subject Name	Molecular Pharmacology

Syllabus

Introduction to Molecular Biology and Molecular Genetics: DNA and genome, basic double helix structure, flow of genetic information, molecular basis of transcription and protein synthesis.

Molecular mechanism of drug action. Receptor Occupancy and Cellular Signaling systems, such as G-Proteins, Cyclic nucleotides, Calcium and Phosphatidyl inositol, Ionic channel and their modulators. Endogenous bioactive molecules as TNF- α , Interleukins, Process of Apoptosis, Arachidonic acid metabolites, COX-2 regulators and their role in inflammation.

Principles of Gene Therapy: Gene transfer technologies, clinical applications of gene therapy, different targets of gene therapy, gene-based personalized drug therapy, antisense drugs.

Receptor Interactions and Second Messenger Systems: Role of cyclic nucleotides, phosphoinositides, arachidonic acid, calcium and nitric oxide in cellular signalling. Pharmacology of toll-like receptors.

Stem Cell: Introduction to stem cell biology and its implications in modern medicine.

Drug metabolism, pharmacogenetics and metabolic disorders with special reference to carbohydrate and lipid metabolism.

Suggested Readings/Books:

1. Lodish H, Baltimore D, Berk A, Zipursky SL, Matsundaira P and Darnell J. Molecular Cell Biology. WH Freeman & Company, New York. Latest Edition.
2. Brown TA. Gene Cloning and DNA Analysis. Blackwell Science, USA. Latest Edition.
3. Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watsaon JD, Eds. Molecular Biology of the Cell. Garland Publishers, New York. Latest Edition.
4. Muller RF and Youngh ID, Eds. Emmerly's Elements of Medical Genetics. Churchill Livingstone, New York. Latest Edition.



Course	M. Pharm	Semester	Second
Branch	Pharmacology	Duration	60 Hrs[Theory]
Subject Code	MPCL203[T]	Subject Name	Drug Discovery and Toxicology

Syllabus

Introduction to Drug Discovery: History of drug discovery, sources of drugs (plants, animals, microorganisms, drugs from organic synthesis), existing drugs as a source of new drug, lead identification and optimization.

Preclinical Studies and Drug Development: Stages of drug discovery, pre-clinical and safety evaluation, acute, sub-acute, chronic studies, *in vivo* and *in vitro* studies (behavioral, biochemical, neurochemical models) and special studies including carcinogenicity, mutagenicity, teratogenicity.

Novel Drug Targets for Drug Discovery: Exploration and investigation of therapeutic drug targets as enzymes, receptors, genes, platelets and matrix metalloproteases for drug design.

Toxicology: Concept, development and scope of toxicology, behavioural and neurotoxicity, teratology, endotoxin, pesticides, cardiac, hepatic, renal and pulmonary toxicity. Industrial, environmental and forensic toxicology, clinical toxicology, principles and management of different types of poisoning. Principles of toxicity evaluations i.e., ED₅₀, LD₅₀ and TD values.

Immunotherapy: Introduction to immune system, cellular and humoral immunity, complement, antigen antibody interactions, immunity to bacteria, virus, protozoa, and fungi, immunomodulators and immunosuppressants and their use in autoimmune disorders, principles and development of vaccines against different diseases.

Pharmacovigilance, Frequency and importance of adverse drug reaction, Pharmacovigilance methods, Setting up and operating a Pharmacovigilance centre, terminologies, Resources for pharmacovigilance centre, Role of pharmacist, Computer system in recording and interpretation of adverse drug reaction (ADR) information, Interpretation and use of information from spontaneous ADR reporting systems.

Suggested Readings/Books:

1. Bartfai T and Lee GV. Drug Discovery. Elsevier, New York. Latest Edition.
2. Huang Z. Drug Discovery Research. Wiley InterScience, USA. Latest Edition.
3. Evans RP, Drug and Biological Development. Springer, USA. Latest Edition.
4. Ricky NG. Drugs from Discover to Development. Wiley-Blackwell, USA. Latest Edition.



5. Ballantyne B, Marrs T and Turner P. General and Applied Toxicology. Macmillan Press Ltd., London. Latest Edition.
6. Goldsby RA, Kindt TJ and Osborne BA. Kuby's Immunology. WH Freeman Book, New York. Latest Edition.
7. Klaasen KCD and Amdur MA. Casarett & Doull's Toxicology. Mcmillan Press Ltd., London. Latest Edition.



Course	M. Pharm	Semester	Second
Branch	Pharmacology	Duration	60 Hrs[Theory]
Subject Code	MPCL204[T]	Subject Name	Experimental Pharmacological Techniques

Syllabus

Development and scope of experimental pharmacology: common laboratory animals, breeding methods, anesthesia & euthanasia of experimental animals, different routes of drug administration.

Regulations for laboratory animal care and ethical requirements. CPCSEA guidelines for performing experiments on animals. Alternatives to animal screening, cell lines and other *in vitro* techniques i.e. ELISA, PCR techniques, etc.

Experimental techniques employed in the screening of drugs belonging to following categories:

Antipsychotics, antianxiety agents, nootropics, antidepressants, antiparkinsonian agents, antiepileptics, analgesics and anti-inflammatory agents.

Antianginals, antiarrhythmics, antiatherosclerotics, antihypertensive agents and drugs used for myocardial infarction.

Antidiabetic and antiobesity drugs.

Antiulcer, antimalarial and anthelmintic agents.

Hepatoprotectives and renoprotectants.

In vitro and *in vivo* antioxidant screening.

Bioassay design and techniques: Principle, types and methods of bioassays, advantages over other assays. Official bioassays. Bioassay of official drugs like adrenaline, nor-adrenaline, acetylcholine, histamine, angiotensin, dtubocurarine, insulin, digoxin, oxytocin, estrogen, thyroxine, corticotrophin, somatotrophin, etc. Biological standardization of vaccines and sera. Experimental models and statistical experimental designs employed in biological standardization. Statistical quality control. Development of new bioassay.

Genetically modified animals as tools of experimental pharmacology: Transgenic animals and their applications in drug discovery, techniques involved in transgenic technology and gene knockout animals.

Suggested Readings/Books:



1. Vogel HG and Vogel WH. Drug Discovery and Evaluation. Springer-Verlag, Berlin. Latest Edition.
2. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata. Latest Edition.
3. Recent journals in experimental pharmacology.



Course	M. Pharm	Semester	Second
Branch	Pharmacology	Duration	120 Hrs [Practical]
Subject Code	MPCL205[P]	Subject Name	Pharmacology Practical- II

Practicals:

Practical exercises based on the topic mentioned in theory syllabus of second semester.



RKDF University

MASTER OF PHARMACY (M. PHARM.): PHARMACOLOGY

(Two year post graduate degree course)

CREDIT BASED SEMESTER SYSTEM

SCHEME OF TEACHING, EXAMINATION AND SYLLABUS

M. Pharm. III Semester

w.e.f. ACADEMIC SESSION 2013-2014



RKDF University

Bhopal (MP) 462033, INDIA



M. Pharm : Pharmacology

Scheme of Teaching and Examination

M. Pharm III Semester								
Subject Code	Name of Subject	Teaching Scheme (hrs/week)		Credits		Examination Scheme		
		T	P	T	P	T	P	
							Ext	Int
MPCLDIS-I	Dissertation - I	-	36	-	18	-	180	120
Total		36 hrs/week		18		300		

T- Theory, P- Practical, Ext- External, Int- Internal

Practical: 2 Practical hour = 1 Credit

Internal assessment (Practical) Based on dissertation work and *viva-voce*.



Course	M. Pharm	Semester	Third
Branch	Pharmacology	Duration	36 Hrs/Week
Subject Code	MPCLDIS-I	Subject Name	Dissertation - I

Research work during third semester.

The examination shall be based on dissertation - I submitted at the end of third semester and presentation in open seminar.



RKDF University

MASTER OF PHARMACY (M. PHARM.): PHARMACOLOGY

(Two year post graduate degree course)

CREDIT BASED SEMESTER SYSTEM

SCHEME OF TEACHING, EXAMINATION AND SYLLABUS

M. Pharm. IV Semester

w.e.f. ACADEMIC SESSION 2013-2014



RKDF University

Bhopal (MP) 462033, INDIA



RKDF University

M. Pharm : Pharmacology

Scheme of Teaching and Examination

M. Pharm IV Semester								
Subject Code	Name of Subject	Teaching Scheme (hrs/week)		Credits		Examination Scheme		
		T	P	T	P	T	P	
							Ext	Int
MPCLDIS-II	Dissertation - II	-	36	-	18	-	180	120
Total		36 hrs/week		18		300		

T- Theory, P- Practical, Ext- External, Int- Internal

Practical: 2 Practical hour = 1 Credit

Internal assessment (Practical) Based on dissertation work and viva-voce.



Course	M. Pharm	Semester	Fourth
Branch	Pharmacology	Duration	36 Hrs/Week
Subject Code	MPCLDIS-II	Subject Name	Dissertation - II

Research work during third and fourth semester.

The examination shall be based on dissertation - II submitted at the end of Fourth semester and presentation in open seminar.