1.4 M.Sc. (Medical Pharmacology)

1st Year

Paper Code	Subject	Evaluation Scheme			
		Univ. Exam.	IA	Viva	Total
0105101	Basics of Anatomy	100	20	20	140
0105102	Basics of Physiology	100	20	20	140
0105103	Basics of Biochemistry	100	20	20	140
0105104	Biostatistics & Research Methodology	80	20	-	100
0105105	Basics of Anatomy (Practical)	40	20	-	60
0105106	Basics of Physiology (Practical)	40	20	-	60
0105107	Basics of Biochemistry (Practical)	40	20	-	60
Total		**500**	**140**	**60**	**700**

2nd Year

1. Course prescribed in the 3rd year will be taught in both 2nd & 3rd years, but there will be no formal examination in 2nd year.
2. The student will conduct Research, collect literature for Dissertation, and give seminars during second year.

3rd Year

Paper Code	Subject	Evaluation Scheme			
		Univ. Exam.	IA	Viva	Total
0105301	General Pharmacology Principles & Applied Sciences	75	60	40	100
0105302	Systematic Pharmacology, Chemotherapy & Therapeutics	75			100
0105303	Experimental Pharmacology, Bioassay & Recent Advances	75			100
0105304	Clinical Pharmacokinetics & Recent Advances	75			100
0105305	Pharmacology (Practical)	150	50	-	200
Total		**450**	**110**	**40**	**600**

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M.Sc. (MEDICAL PHARMACOLOGY) – 2ND YEAR

GENERAL PHARMACOLOGICAL PRINCIPLES AND APPLIED SCIENCES

1. Introduction: Definition nature & sources of drugs dosage forms, drug Nomenclature etc
2. Complimentary Alternative Medicine.
3. Pharmacokinetics I
   (a) Absorption: General Principles passage of drugs across biological membranes, factors affecting absorption, transport, bioavailability. Routes of administration: Advantages & disadvantages of important routes used.
   (b) Distribution: Plasma protein binding, biological barriers (BBB& Placental), volume of distribution, tissue storage.
   (c) Biotransformation: Principle phases (I & II), sites, types with examples. Factors affecting (Induction, Inhibition, First pass effect).
   (d) Elimination: Routes, Kinetics Half-Life, Loading dose, Maintenance dose.
4. Methods of prolongation of drug effect, Posology & Factors modifying dose of a drug.
   (a) Pharmacodynamics I : Principles of drug action, mechanism of drug action, Receptors, Agonist, partial agonist, inverse agonist etc. Transducer mechanism.
   (b) Pharmacodynamics II : Dose-response relationship, Drug efficacy & potency, Therapeutic index, LD 50 & ED 50, synergism, Drug antagonism.
5. Factors modifying drug action.
   (a) Adverse drug reactions.
   (b) Drug Interactions, Phases of drug development, Generic name , trade name. Fixed dose combinations. Rational Drug concept : P Drugs, Essential drugs, Evidence based Medicine.
   (c) Pharmacovigilance, Pharmacoeconomics and Drug Information
   (d) Toxicology : General principles of treatment of poisoning including snake bite and animal stings. Heavy metal poisoning and heavy metal antagonists.
6. Management of over dosage with commonly used therapeutic agents.
   (a) Pharmacogenetics : Pharmacogenomics and Personalized Medicine
   (b) Wonder Discoveries in Pharmacology
7. Nobel laureates in Pharmacology and their revolutionary discoveries Practical Skills:
   (a) Dosage forms - Oral, Parenteral, Topical & Others
   (b) Routes of drug administration, setting up of an intravenous drip
   (c) Calculation of drug dosage
   (d) Sources of drug information – how to retrieve information
   (e) ADR monitoring
   (f) Therapeutic Drug Monitoring
   (g) Critical appraisal of drug promotional literature
   (h) Essentials of Clinical trials
   (j) Communicating of patients on the proper use of medication
   (k) Selection of P drug
   (l) Prescription writing, prescription auditing and standard treatment protocols
   (m) General Principles of Pharmacy

(n) Preparation and dispensing of powders, emulsion ointments, mixtures, liniments, suppositories and syrups
(o) Spotting exercise – Identify the commonly used items in Pharmacology
(p) Exercise on drug interactions
(q) Essential drug list
(r) Use of drugs in pregnancy, lactation children and elderly
(s) Use of drugs in liver disease and renal disease
(t) Ethics in clinical trials, therapy

M.Sc. (MEDICAL PHARMACOLOGY) – 2ND YEAR

SYSTEMIC PHARMACOLOGY, CHEMOTHERAPY & THERAPEUTICS

1. Autonomic nervous system
2. Central nervous system
3. Autacoids
4. Drugs affecting kidney function and Cardiovascular system
5. Drugs affecting gastrointestinal and respiratory system
6. Drugs affecting uterine motility
7. Chemotherapy of parasite infections
8. Chemotherapy of microbial diseases
9. Antineoplastic agents
10. Immunomodulators
11. Drugs acting on blood and blood forming organs
12. Hormones and hormone replacement therapy
13. Miscellaneous
14. Vitamins (water soluble and fat soluble vitamins).
15. Heavy metals and heavy metal antagonists.
16. Ocular and dermato-pharmacology .
17. Recent developments in Pharmacology
18. Gene therapy and Therapeutic gases.
19. Free radical biology and antioxidants,
20. Pharmacology of bisphosphonates, melatonin-therapeutic potential.
21. Pharmacotherapy of migraine,
22. Drug therapy in Alzheimer's disease and male sexual dysfuntion.
23. Hormone replacement therapy.

M.Sc. (MEDICAL PHARMACOLOGY) – 2ND YEAR

TEACHING METHODOLOGY

1. Challenges for teachers in Medical Education.
2. Teaching strategies :
   - (a) Lecture method
   - (b) Small group teaching
   - (c) Inquiry and problem solving methods
   - (d) Case study
   - (e) Team projects
   - (f) Presentation
   - (g) Seminar
   - (h) Field visit
   - (i) Simulation
   - (j) Computer-based instructions
   - (k) Bed side learning
   - (l) One to one teaching
   - (m) Self directed teaching
3. Preparation of lesson.
4. Selection of teaching methods.
5. Identification and review of literature.
6. Identification of teaching resources.
7. Developing teaching aids for instructional activities that link research and theory to practice.
8. Contact development; key element of curriculum design and evaluation.
9. Implementation and monitoring of curriculum transaction and student's evaluation.
10. Student feedback: Designing and implementation.
11. Research paper writing.

M.Sc. (MEDICAL PHARMACOLOGY) – 2ND YEAR

PRACTICAL

1. Effect of anti-inflammatory agents on caraagennian induced rat paw edema. Evaluation of analgesic activity of morphine using tail flick latency test. Demonstration of Dale's vasomotor reversal and nicotinic effect of acetylcholine on dog blood pressure.(through e-lab). Effect of autonomic drugs on rabbit intestine. Effect of sedatives & skeletal muscle relaxants on rodents (rotarod test).
2. Prescription writing for common diseases in the proper format.
3. Audit a given prescription.
4. Criticize & evaluate pharmaceutical company's literature.
5. Recognise signs and symptoms of common drug over dosage and poisons and how to treat them.
6. Calculate the cost- effectiveness of various drug regimens for common illness.
7. Interpret graphs & charts of Experimental and Clinical Pharmacology.

M.Sc. (MEDICAL PHARMACOLOGY) – 3RD YEAR

CLINICAL PHARMACOKINETICS & RECENT ADVANCES

1. **Pharmacokinetics:**
   Basics of pharmacokinetics, calculation of pharmacokinetic estimates (C-max, Tmax, T1/2, AUC(0-n), AUC(0-μ), Vd, Ke, Ka etc.) Compartment models used in pharmacokinetics (oral and intravenous). Compartment fitting (one comp & two comp). Pharmacodynamic /pharmacokinetic (PD/PK) correlation.
2. **Drug Regulations:**
   Drugs and Cosmetics Act, Drug Price Control order, Application for Investigational New Drug (IND), Application for New Drug Discovery (NDD) according to Indian Control Authority & USFDA guidelines. Conducting bio-equivalence studies. Ethical considerations in utilizing human subjects for drug discovery process. Helsinki's declaration. ICH-GCP Guidelines. Ethical guidelines in utilising animals for experimental purposes.
3. **Drug Development Process:**
   Methods involved in the development of new drugs. Preclinical toxicological studies. Calculation of LD50 & ED50. Acute, subacute and chronic toxicity studies. Pre-clinilcal pharmacokinetic and dynamic studies. High throughput screening (invitro and invivo) for pre-clinical pharmacokinetic and pharmacodynamic studies.
4. **Therapeutic Drug Monitoring:**
   Basic principles of TDM. Therapeutic index. Trough level monitoring and dosage adjustments. Drug delivery systems: sustained release, enteric coated formulations and liposome etc. Four point assay of histamine and acetylcholine on guinea pig ileum. Identification of unknown by evaluating its action on dog haemodynamic parameters(through e-lab)

M.Sc. (MEDICAL PHARMACOLOGY) – 3RD YEAR

EXPERIMENTAL PHARMACOLOGY, BIOASSAY AND RECENT ADVANCES

1. Experimental methodologies involved in the discovery of drugs (in vivo, in vitro, ex vivo). Animal handling and animal care. Methods of anaesthetising animals and methods of euthanasia. Restraining and blood collecting methods. Drug screening methods involved in the evaluation of anti-ulcer, antidepressant, anti-anginal, antihypertensive, anti-arrhythmic, anti-diabetic, anti-cataract, anti-platelet, anticancer, anti-inflammatory, anti-diarrhoeal, antiepileptic, analgesic, anti-thyroid, antipyretic, anti-glaucoma, anti-hyperlipidemic anti-asthmatics drugs and cough suppressants. Drug screening methods used in screening antifungal, anti-helminthic, antibacterial, antiviral agents, drugs for heart failure, posterior pituitary, adrenal steroid (gluco & mineralo corticoids), testicular, parathyroid, ovarian, thyroid hormones, Methods involved in testing teratogenicity, carcinogenicity and organ toxicities in animals.
2. Instrumentation In Drug Analysis.
3. Qualitative testing, titrimetric analysis. Beer and Lambert's law. Basis and working principle of colorimeter, ultraviolet, atomic absorption spectrometers, Fluorescence spectroscopy, NMR and Mass Spectroscopy. Basics of Chromatography. Partition, adsorption and ion exchange chromatography. Column chromatography, thin layer chromatography, paper chromatography, immune-absorbant chromatography, high performance thin layer Chromatography, high performance liquid chromatography (HPLC) and gas Chromatography. Radio immunoassay. Processing of biological materials for drug analysis. Calculations in drug analysis. Good laboratory practice. Validation of analytical procedure.

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M.Sc. (MEDICAL PHARMACOLOGY) – 3RD YEAR

TEACHING PRACTICE

1. To acquire competence to plan for instructions and delivery of curriculum.
2. To obtain feedback both about teaching as well as student learning
3. To develop broad understanding of modern principles and procedures used in medical science education
4. To develop essential skills for practicing modern medical science teaching

For teaching practice, the student shall take classes as decided and allocated by the Department. For evaluation purpose, a board of three examiners comprising one internal and two external examiners will be appointed by the Vice-Chancellor from the panel of examiners recommended by the Dean/Faculty of the Faculty/College. All the three examiners will assess the student separately and average of these marks shall be awarded as final marks to the student concerned.

M.Sc. (MEDICAL PHARMACOLOGY) – 3RD YEAR

PRACTICAL

1. Spectrophotometric & flurimetric estimations of drugs in biological fluids
2. Calculation for statistical significance in the given data for Student paired and unpaired t test.
3. Applying ANOVA to the given set of concentration vs time data of two drug formulations to comment about their bio-equivalence.
4. Draft an IND and NDD application for the approval of a numbered compound

*Practical exercise using animal experiments is subject to institutional animal ethical committee approval

M.Sc. (MEDICAL PHARMACOLOGY) – 3RD YEAR

DISSERTATION

Guidelines:

1. Each M.Sc. Medical student will carry out research work under the supervision of a faculty member (Guide) with post-M.D./ Ph.D. teaching experience of three years or more in the subject. However, a teacher with M.D/Ph.D. degree in the subject or related subjects shall be qualified for being taken in as Co-guide.
2. A Guide will be allotted to each student at the commencement of second year. The student will prepare a Plan of **Dissertation** under the supervision of the Guide and submit it to the Ethical Committee within two months of the commencement of second Year. The Committee will convey approval/disapproval of the Plan within one month.
3. In case, the Plan is disapproved, a fresh Plan must be submitted within one month. After approval of the Plan, the student will begin work on the **Dissertation**.
4. The progress of work will be monitored regularly by the Guide. The **Dissertation** not exceeding 100 pages typed on A4 paper on one side only in double spacing is to be submitted to the University through the Guide six months before the date of 3rd year University examination.
5. The **Dissertation** will be evaluated by a panel of examiners (1 external & 1 internal at least) approved by the Vice-Chancellor. The approval of the Thesis by the panel will be a pre-requisite for the candidate to appear in the written/practical examination of 3rd year. If the **Dissertation** is returned for revision, the suggested revision must be done and the revised **Dissertation** submitted for evaluation to the examiner (s) who has/have suggested for the revision.
6. After approval of the revised **Dissertation**, the candidate can appear in the next 3rd year examination, provided the approval is received one month before the examination. If the thesis is disapproved, the entire process from submission of a new Plan to submission of **Dissertation** is to be repeated. On approval of new **Dissertation**, the candidate can appear in the next 3rd year examination, provided there is a one month gap between the receipt of approval and commencement of examination.
7. **Vancouver style of citations will be followed for citation of references in the Dissertation.**

Note: A student is required to submit four hard copies of the **Dissertation** along with the soft copy in the prescribed format given by the University.

Books Recommended (Latest edition):

1. Hardman, J.G., L.E. Limbird, ed. *Goodman & Gillman's The Pharmacological Basis of Therapeutics*. 11th ed. New York: McGraw Hill, 2006.
2. Katzung, B.G., ed. *Basic and Clinical Pharmacology*. London: Prentice-Hall.

3. Satoskar, R.S., S.D. Bhandarkar, ed. *Pharmacology and Pharmacotherapeutics*. Bombay: Popular Prakashan.
4. Tripathi, K.D., ed. *Essentials of Medical Pharmacology*. New Delhi: Jaypee Brothers.
5. Gupta, S. K. *Drugs Screening Method.*
7. Kohli, K, ed. Contemporary Perspectives on Clinical Pharmacotherapeutics. Amsterdam: Elsevier.
8. Ghosh, M.N. *Fundamentals of Experimental Pharmacology.* Kolkata: Scientific Book Agency, 1984.
9. Vogel, H.G. and W.H.Vogel, ed. *Drug Discovery and Evaluation: Pharmacological Assays*. New York: Springer-Verlag, 1997.
10. Indrayana. *Biostatistics for Undergraduates.*
11. Mahajan, B.K. *Methods in Biostatistics*. 7th ed.
12. Jagdeesh, G, ed. *Biomedical Research.*

Journals to be referred:

1. Trends in Pharmacological Sciences.
2. Annual Review of Pharmacology.
3. Pharmacological Reviews.
4. Indian Journal of Pharmacology.
5. Indian Journal of Physiology and Pharmacology.
6. Pharmacology and Experimental Therapeutics.
7. Journal of Ethnopharmacology.
8. Nature,
9. Science.
10. European Journal of Clinical Pharmacology.
11. BJCP.