MSc in Medical Pharmacology Curriculum

Prepared by;

Department of Pharmacology

AIIMS, Nagpur-18

Curriculum— MSc in Medical Pharmacology

Goal

The goal of postgraduate M.Sc. in medical pharmacology shall be to produce competent researchers, academicians and to get the placement in pharmaceutical industry

Objectives

At the end of the postgraduate training in the discipline concerned, the student shall be able to;

- Attain the optimal knowledge of pharmacology and experimental techniques used to assess biological systems' pharmacological responses to drugs.
- Demonstrate competence in basic concepts of research methodology and be able to analyze relevant published research literature critically
- Gain an insight into how various chemicals/drugs affect cellular systems.
- Develop skills in using educational methods and techniques to train medical/nursing students and paramedical health workers.

Programme specific outcome:

1. The student, after undergoing the required training, should be able to deal with the allied departments and render services in advanced laboratory investigations
2. The student should acquire basic skills in teaching medical/paramedical students
3. The student should know the principles of research methodology and self-directed learning for continuous professional development.

Course outcome:

a. The student should be able to explain clearly the concepts and principles of Pharmacology and therapeutics.
b. The student should also be able to explain the drug development processes
c. The student should be able to effectively teach undergraduate students in medicine (MBBS) and allied health science courses
d. The student should be able to carry out a research project from planning to publication and pursue academic interests and continue life-long learning to become more experienced in all the above areas and eventually be able to guide postgraduates in their thesis work.

Duration of the course:

2 years (Course will comprise four semesters of 6 months each)

Eligibility:

- BSc graduates of biological sciences.
- B.Sc. Zoology/Microbiology/Physiology
- MBBS/BDS/BAMS/BHMS

Curricular structure and design:

1st year: I Sem- General pharmacology, ANS, Research methodology and Biostatistics, Autocoids and Cardiovascular system including Diuretics

II sem- Blood & blood forming organs, Hypolipidemic agents, Central nervous system, local anaesthetics, Skeletal muscle relaxants, NSAID's

2nd year: III sem- Drugs used for GIT, Respiratory, cutaneous and Endocrine disorders

IV sem- Chemotherapy, immunopharmacology & miscellaneous topics

Mop-up biostatistics

Syllabus:

SECTION 1: GENERAL PHARMACOLOGICAL PRINCIPLES

Introduction, Routes of administration

Pharmacokinetics: Membrane Transport, Absorption and Distribution of Drugs

Pharmacokinetics: Metabolism and Excretion of Drugs, Kinetics of Elimination

Pharmacodynamics: Mechanism of Drug Action; Receptor Pharmacology

Aspects of Pharmacotherapy, Clinical Pharmacology and Drug Development

Adverse Drug Effects& toxic effects including antidotes

Drug delivery systems: sustained release, enteric coated formulations & liposome etc.

Pharmacovigilance, Pharmacoeconomics, Pharmacogenetics and Drug Information

SECTION 2: SYSTEMIC PHARMACOLOGY

Autonomic nervous system

Central nervous system

Autocoids

Drugs affecting kidney function and Cardiovascular system

Drugs affecting gastrointestinal and respiratory system

Drugs affecting uterine motility

Chemotherapy of parasite infections

Chemotherapy of microbial diseases

Antineoplastic agents

Immunomodulators

Drugs acting on blood and blood forming organs

Endocrine system

Dietary supplements

Vitamins (water soluble and fat-soluble vitamins).

Heavy metals and heavy metal antagonists.

Ocular and dermato-pharmacology.

Recent developments in Pharmacology

Gene therapy.

Therapeutic gases.

Free radical biology and antioxidants

Miscellaneous: Vaccines, antisera & immunoglobulins

Section 3: EXPERIMENTAL PHARMACOLOGY, BIOASSAY AND STATISTICS AND RECENT ADVANCES

3.a. Experimental methodologies involved in the discovery of drugs (in vivo, in vitro).

Animal handling and animal care: Methods of anaesthetizing animals and methods of euthanasia. Restraining and blood collecting methods.

Drug screening methods involved in the evaluation of anti-ulcer, antidepressant, antianginal, antihypertensive, antidiabetic, anti-inflammatory, antiepileptic, analgesic, antithyroid, antipyretic, antihyperlipidemic, anti-asthmatics drugs

Methods involved in testing teratogenicity, carcinogenicity, mutagenicity and organ toxicities in animals.

Practical Skills:

- Evaluation of analgesic activity in various models
- Effect of autonomic drugs on dog BP using CAL
- Effect of sedatives on rodents (rotarod test).
- Evaluation of antianxiety effect of drugs

❖ **Bioassay methods:**

- Animal experiments: Ethical considerations, Institutional Animal Ethics Committee approval, applicable regulatory guidelines (CPCSEA), humane care of animals and alternatives to animal experimentation.
- Anaesthetics used in laboratory animals
- Principles of EC50, ED50, pD2 and pA_2 values of drugs
- Describe methods of bioassay for estimation of: Acetylcholine, histamine,
- Assays: Concept, types of bio-assays and their application/s

3.b. BIOSTATISTICS

Calculation of basic statistical parameters (mean, median, mode, standard deviation, standard error etc.). Null hypothesis, parametric and non-parametric tests, Metanalysis.

Practical skills: Calculation for statistical significance in the given data for the students paired and unpaired 't test. Applying ANOVA to the given set of concentration vs time data of two drug formulations to comment about their bio-equivalence.

They should be able to master the utilization of Microsoft excel

3.c. DRUG REGULATIONS

Drugs and Cosmetics Act, Drug Price Control order, Application for Investigational New Drug (IND),Application for New Drug Discovery (NDD) according to the Indian Regulatory Authority & USFDA guidelines.

Ethical considerations in utilizing human subjects for drug discovery process. Helsinki's declaration. ICH-GCP Guidelines, New Drugs and Clinical Trials Rules (NDCT)

Ethical guidelines in utilizing animals for experimental purposes.

3.d. DRUG DEVELOPMENT PROCESS

Methods involved in the development of new drugs. Preclinical toxicological studies. Calculation of LD_{50} & $ED_{50.}$ Acute, subacute and chronic toxicity studies.

Preclinical pharmacokinetic and dynamic studies.

High throughput screening and other methods of drug discovery

3.e. THERAPEUTIC DRUG MONITORING

Basic principles of TDM. Therapeutic index. Trough level monitoring and dosage adjustments.

TEACHING-LEARNING METHODS:

Learning in a PG program is primarily self-directed, and in M.Sc., medical pharmacology consists of laboratory and academic work. The formal sessions are merely meant to supplement this core effort.

Formal teaching sessions:

• **Seminars:** To update newer developments in pharmacology/emerging trends/ novel mechanisms of drug action etc.

• **Drug review:** To update and criticize about the newly approved drugs

• **Journal club:** To familiarize research methodologies and application of statistics in experiments

• **Practical exercises:** Once in a week, under the supervision of a faculty, with/without the use of animals, various principles/ mode of drug action/ screening of drugs/ drug analysis using multiple techniques should be performed to develop practical skills to conduct similar experiments in future. ADR monitoring as per the SOP by the PvPI

• **Logbook:** During the training period, the postgraduate student should maintain a Log Book giving details of experimentation done and skills acquired

❖ Attend accredited scientific meetings (CME, symposia, and conferences).

- **<u>Dissertation Submission</u>: -**
- Every candidate shall carry out work on an assigned research protocol under the guidance of a recognized Postgraduate teacher; the protocol shall be written and submitted in the form of a Dissertation.
- Every candidate shall submit a dissertation plan in the form of a synopsis to the Academic section within the given time frame.
- The process is to be completed within six months of admission to the MSc program

Activity	**Month**
Admission to the course	July
Allotment of PG guide and Selection of the topic in consultation with PG Guide and synopsis submission	September/October
Approval of synopsis by Department PG Committee	November
Institute Scientific Committee approval	
Institute Ethics Committee approval	
Submission of synopsis to Academic Section	1st December
Final approval letter by the Academic Section	31stDecember

- The dissertation shall be submitted to the Academic section six months before the commencement of the theory examination.
- **ASSESSMENT:**
- At the end of 1st year, the department conducts theory, practical and oral examinations on the systems scheduled for the year and maintains a record of the internal assessment.
  At the end of the last (4th) semester, the students will appear for the professional examination and which will be conducted by the examination section.
- **Eligibility for the exam:**

Sr. No.	**Parameter**	**Criteria**
1	Research Methodology Examination conducted at the end of Induction Programme	Pass
2	Internal Assessment marks	>50% marks separately in theory and practicals
3	Dissertation	Accepted
4	MSc Programme attendance	>80%in each year
5	Poster and Paper presentation in the Conference	1 poster or 1 paper presentation
6	Publication in a peer reviewed, indexed journal	One (Accepted /published/Sent for publication)

7	Six Monthly Progress Report	At least 3out of 4 satisfactory progress reports

Note: Dissertation shall be submitted to the Academic section six months before the commencement of theory examination.

- **Marking system:**

Exam	**1st Year**	**Pre-professional exam**	**Professional Exam**		
Theory	1 paper 100 marks	3 Papers 100 marks each	Paper	Marks	Total
			I	100	**300**
			II	100	
			III	100	
Practical including Viva	100 marks	300 marks	Heads	Marks	Total
			Practical	250	**300**
			Viva	50	
Dissertation		NA	Heads	Marks	Total
			Evaluation	200	**300**
			Viva	100	

Professional examination:

A. Theory examination: Allotment of the topics

Paper- I: General pharmacological principles (section -1)

Paper-II: Systemic pharmacology(section-2)

Paper III: Experimental pharmacology, bioassay, statistics, and recent advances (section-3)

B. PRACTICAL EXAMINATION (Exercises which will be used for assessment)

(1) One exercise on intact animal**/isolated organ** as per the norms of CPCSEA

(2) One chemical pharmacology exercise followed by biological confirmation/Therapeutic problem

(3) Calculating the pharmacokinetic parameters for the scenario given

(4) Critical appraisal of a published paper/Criticize promotional drug literature

(5) Protocol designing/Short animal experiment

(6) ADR reporting and causality assessment/Micro-teaching

❖ Passing criteria:

a. 50% marks in each theory paper and practical separately.

b. 50% marks in dissertation Evaluation.

c. 50% marks in Dissertation Viva

- **Timeline:**

Course work	1st semester	2nd semester	3rd semester	4th semester
Attending UG classes				
Seminars, Journal Clubs, & Faculty Presentations				
PG Practicals				
TeachingMeetings				
Dissertation Work	Protocol Submission	Data collection	Dissertation	Thesis submission
Assessment		1st internalexam		Pre-professional & professional exam
Time Line	0-6 months	06-12 months	12-18 months	18-24 months

Books recommended:

1. Brunton LL, Hilal-Dandan R, Knollmann BC. Goodman & Gilman's The Pharmacological Basis of Therapeutics; 13th Ed, McGraw-Hill Education: New Delhi, 2018.
2. Shargel L, Andrew B.C. Yu. Applied biopharmaceutics and pharmacokinetics; 7th Ed, McGraw-Hill Education: New Delhi, 2016
3. Ghosh MN. Fundamentals of experimental pharmacology; 7th Ed, Hilton & Company: Calcutta, 2019 (ISBN: 9788190296507)
4. Tripathi KD. Essentials of Medical Pharmacology; 8th Ed, Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2019 (ISBN: 978-93-5270-499-6)

5. Vogel HG. Drug Discovery and Evaluation: Pharmacological Assays; 3rd Ed, Springer International Publishing AG: Berlin, 2007 (ISBN: 3540714200)
6. Gupta SK. Drug Screening Methods; 3rd Ed, Jaypee Brothers Medical Publishers (P) Ltd: New Delhi,2016 (ISBN: 9789351529828)
7. Medhi B, Prakash A. Practical Manual of Experimental and Clinical Pharmacology; 2nd Ed, Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2017 (ISBN: 9386150727)

Journals to be referred:

Trends in Pharmacological Sciences, Annual Review of Pharmacology,

Pharmacological Reviews, Indian Journal of pharmacology,

Indian Journal of Physiology and Pharmacology, Annals of Pharmacotherapy,

Pharmacology and Experimental Therapeutics, Journal of Ethnopharmacology,

Nature, Science, European Journal of Clinical Pharmacology,

BJCP and other pharmacology related journals