

P.G. Curriculum M.D. Pharmacology Index

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Curriculum

M.D. Pharmacology

The composition of the department in terms of faculty strength; other staff, laboratory equipment and number of PG residents will be as per MCI regulations.

1. Goals

The aims of MD course in Pharmacology are:

- ❖ To train a medical graduate to be a Pharmacologist who is well versed with the basic principles of Pharmacology and is up to date with the recent advances.
- ❖ Acquisition of skills related to teaching, research methodology and corporate world.
- ❖ Knowledge of elementary statistics and its applications.
- ❖ Overall development of skills and personality of the PG resident.
- ❖ Broaden the scope of Pharmacology from bench to bed side.

2. Objectives

At the end of the MD course in Pharmacology, the student should be able to:

- ❖ Recognize the importance of Pharmacology as a key branch in health sciences
- ❖ Utilize the acquired knowledge in teaching, research and industry.
- ❖ Plan and organize projects using managerial and leadership skills.
- ❖ Understand and apply ethical principles involved in animal and human experiments.
- ❖ Handle animals to conduct experiments e.g. screening of various drugs
- ❖ Perform qualitative and quantitative identification and estimation of drugs in different samples of body fluids.
- ❖ Develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and be able to critically analyze relevant published literature
- ❖ Design protocol for clinical trials
- ❖ Incorporate knowledge of information technology in medical sciences
- ❖ Function as a productive member of a team engaged in research, education and industry
- ❖ Play the assigned role in the implementation of national health programs effectively, including planning of drug procurement and distribution.

3. Syllabus

3.1. Theory

- ❖ Clinical and Basic Sciences as applied to Pharmacology
 - Central Nervous System
 - Autonomic Nervous System
 - Cardiovascular System
 - Hematopoietic System
 - Kidney/Renal System
 - Endocrinology
 - Respiratory System

- Gastrointestinal System
- Microbial resistance
- Regulation of cell growth and differentiation
- ❖ General Pharmacology
 - Important landmarks in the growth and development of Pharmacology, important contributions of renowned Indian and foreign Pharmacologists
 - Principles and modes of drug administration, source, nature and preparations of drugs
 - Qualitative and Quantitative Pharmacokinetics
 - Pharmacodynamics
 - Drugs interactions, Adverse drug reactions
 - Methods of new drug development
 - Factors modifying drug response
 - Pharmacogenetics and pharmacogenomics
 - Structure-activity relationship of important group of drugs
 - Preclinical evaluation of new drugs and toxicity studies
- ❖ Systemic Pharmacology
 - Autonomic nervous system
 - Central nervous system
 - Cardiovascular system
 - Hematopoietic system
 - Respiratory system
 - Autacoids
 - Gastrointestinal system
 - Renal pharmacology
 - Endocrine pharmacology
 - Chemotherapy
 - Miscellaneous: Vitamins, heavy metals, vaccines & sera, antiseptics etc.
- ❖ Clinical Pharmacology & Therapeutics
 - Rational basis of therapeutics (P-drug concept, Essential drugs)
 - Rational drugs
 - Human and Population Pharmacokinetics
 - Clinical drug evaluation
 - ★ Clinical trial designing
 - ★ Clinical trial ethics
 - ★ Medico-legal aspects of clinical trials
 - Pharmacovigilance
 - Drugs and Cosmetics Act
 - Data archiving and management
 - Drug audit (Pharmacoepidemiology, Pharmacoeconomics)
 - Evidence Based Medicine
 - Statutory and legal requirements for conduct of clinical trials (including drug schedules)
- ❖ Quantitative and Experimental Pharmacology
 - Study design
 - Biostatistics
 - Bioassay
 - Drug-receptor interactions and response including pD_x and pA_x values.
 - Step up and step down methods for LD
 - CPCSEA
 - Alternatives to animal experiments (cell culture, cell lines)

- Screening for Pharmacological activity with special reference to the following activities:
 - ★ Analgesic-Antipyretic
 - ★ Anticonvulsant
 - ★ Sedative-hypnotics
 - ★ Anti-psychotic
 - ★ Anti-depressant
 - ★ Anti-parkinsonian
 - ★ Anti-diabetic
 - ★ Autonomic
 - ★ Anti-anginal
 - ★ Anti-arrhythmic
 - ★ Hypotensive
 - ★ Diuretic
 - ★ Hypoglycaemic
 - ★ Anti-inflammatory
 - ★ Anti-secretory
 - ★ Anti-allergic
 - ★ Local anesthetic
 - ★ Smooth muscle
 - ★ Anti-fertility
 - ★ Anti-cancer

3.2. Practical

- ❖ Experimental Pharmacology:
 - Handling of animals, collection of blood and urine samples.
 - Assembly of organ bath and setting of thermostat.
 - Isolated tissue preparations:
 - ★ To prepare log dose response curve of a suitable drug on:
 - Guinea pig ileum.
 - Guinea pig tracheal chain
 - Guinea pig vas deferens
 - Frog rectus abdominis
 - Rabbit atrium
 - Rat colon
 - Rat uterus
 - Rat gastric fundus
 - Rat anococcygeus muscle
 - ★ To perform four-point bioassay of a suitable drug on:
 - Guinea pig ileum
 - Guinea pig vas deferens
 - Rat colon
 - Rat uterus
 - Rat gastric fundus
 - Frog rectus abdominis
 - To prepare cumulative log dose response curve of a suitable drug on rabbit aorta.
 - To study the stimulatory and depressant effects of drugs on rabbit gut.
 - To study the effect of coronary vasodilator drug on perfused rabbit heart (Langendroff's technique).
 - Determination of ED₅₀ of histamine on guinea pig ileum.

- Determination of ED₅₀ of acetylcholine on frog rectus abdominis muscle.
- Determination of pD₂ values of histamine on guinea pig ileum.
- Determination of pD₂ value of acetylcholine on frog rectus abdominis muscle.
- Determination of pA₂ value of acetylcholine on guinea pig ileum.
- To study the effect of unknown drugs using rabbit eye.
- To study the stimulatory and depressant effects of drugs on Blood Pressure of rat.
- Screening Tests on animals to study the following activities:
 - ★ Motor in-coordination
 - ★ Anxiolytic effect
 - ★ Despair behavior
 - ★ Anticonvulsant effect
 - ★ Diuretic activity
 - ★ Spontaneous motor activity
 - ★ Analgesic effect
 - ★ Conditioned Avoidance Response
 - ★ Antipsychotic effect
 - ★ Anti-inflammatory effect
- ❖ Clinical/human experiments:
 - To study the effect of following activities in healthy human volunteers:
 - To demonstrate the use of any model as an experimental tool on human subjects without administration of any drug/beverage for evaluation of analgesic activity, psychomotor function, cardiac parameters (HR, BP)
 - ★ Physical stress
 - ★ Mental stress
 - To determine lung volumes
 - To perform:
 - ★ EEG
 - ★ Nystagmography
 - ★ Spirometry
 - ★ ECG
 - ★ Treadmill test/Bicycle ergometry/Master Step test
 - ★ Psychomotor tests
- ❖ Chemical analysis:
 - To do chemical estimation of various drugs including sulphonamides and salicylates, chemical identification of alkaloids, glycosides and basic chemical parameters like blood sugar levels, blood urea levels, lipid profile etc.
- ❖ Computer Aided Learning (CAL) Program:
 - Proficiency in using CAL programs for demonstration of effects of drugs on animals.
- ❖ Statistics
 - Use of calculators and electronic spread sheets for understanding of:
 - Elements of data collection and presentation of data
 - Measures of central tendency and dispersion
 - Non parametric tests
 - Parametric tests (including ANOVA)
 - Correlation and regression

4. Teaching Program

Acquisition of practical competencies being the keystone of postgraduate medical education, postgraduate training is skill oriented.

Learning in postgraduate program is essentially self directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort.

4.1. Teaching sessions

The postgraduate students should attend all undergraduate classes taken by their teachers and colleagues and should also be involved in supervised undergraduate teaching. In addition, there should be daily sessions of formal teaching. Each MD student has to present seminars, Journal clubs, Drug Reviews and perform practicals. He/she should be allotted time for thesis related work.

4.2. Teaching Schedule

Following is the suggested departmental teaching schedule:

Item	Frequency
1. Thesis work	Once a week
2. Journal club/Drug review	Once a week
3. Practical (Experimental/Chemical/Human)	Once a week
4. Seminar	Once a week
5. Statistical exercise	Once a fortnight
6. Pharmacokinetic exercise	Once a fortnight
7. Theory test	Once a month
8. Grand viva	Once a year

Note:

- ❖ All PGs are supposed to attend the sessions.
- ❖ All the teaching sessions shall be assessed by the faculty members at the end of each session and marks should be given out of 10 (for participant) & 100 (for presenter) and kept in the office for the purpose of calculation of internal assessment
- ❖ Attendance of the residents at various sessions (including central sessions) should be at least 75%

5. Skills:

The candidates should be conversant with the following techniques:

- ❖ Weighing technique (chemicals & animals)
- ❖ Handling of equipment
- ❖ Handling of small animals including various anaesthetic techniques.
- ❖ Recording of blood pressure (In vivo and Computer Assisted Learning program)
- ❖ Administration of drugs/chemicals to animals (parenteral and enteral routes)
- ❖ Screening of drugs using appropriate models
- ❖ Isolated tissue preparations for log dose response curve and bioassay

- ❖ Use of Cartesian and log graph paper
- ❖ Use of various methods to evaluate drug effects in humans
- ❖ Elementary principles of common chemical techniques such as colorimeter, spectrophotometer, flame photometer etc.
- ❖ Use of appropriate statistical techniques to analyze the results

6. Thesis

- ❖ Every candidate shall carry out work on an assigned research project under the guidance of a recognized Postgraduate Teacher; the project shall be written and submitted in the form of a Thesis.
- ❖ Every candidate shall submit thesis plan to the University within the timeframe specified by the university.
- ❖ Thesis shall also be submitted to the University within the time frame stipulated by the University.
- ❖ The student will: (i) identify a relevant research question; (ii) conduct a critical review of literature; (iii) formulate a hypothesis; (iv) determine the most suitable study design; (v) state the objectives of the study; (vi) prepare a study protocol; (vii) undertake a study according to the protocol; (viii) analyze and interpret research data, and draw conclusions; (ix) write a research paper

7. Assessment

All the PG residents should be assessed daily also periodically for their academic activities by all teachers.

7.1. General Principles

- ❖ The assessment should be valid, objective, and reliable
- ❖ It should cover cognitive, psychomotor and affective domains
- ❖ Formative, continuing and summative (final) assessment should also be conducted in theory as well as practicals. In addition, thesis should also be assessed separately

7.2. Formative Assessment

The formative assessment should be continuous as well as end-of-term. The former is to be based on the feedback from the departmental faculty. End-of-term assessment should be held at the end of each semester (upto the 5th semester). Formative assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.

7.3. Internal Assessment

The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student. Marks should be allotted out of 100 as followed.

Sr. No.	Items	Marks
1.	Personal Attributes	20
2.	Practical Work	20
3.	Academic activities	20
4.	End of term theory examination	20
5.	End of term practical examination	20

1. Personal attributes

- ❖ **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situation shows positive approach.
- ❖ **Motivation and Initiative:** Takes on responsibility, innovative enterprising, does not shirk duties or leave any work pending.
- ❖ **Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
- ❖ **Interpersonal Skills and Leadership Quality:** Gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Practical Work:

- ❖ **Availability:** Punctual, available continuously on duty, responds promptly on assignments and take proper permission for leave.
- ❖ **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in practical work.
- ❖ **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
- ❖ **Performance:** Proficient in presentations and discussion during academic sessions in the department.

3. **Academic Activity:** Performance during presentation at Journal club/Seminar/Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

4. **End of term theory examination:** Written test conducted at end of 1st, 2nd year and 9 months

5. **End of term practical/oral examination:** Practical exam and viva examination at end of 2 years and 9 months

Marks for **personal attributes** and **work done** should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.

Marks for **academic activity** should be given by the all consultants who have attended the session presented by the consultant.

The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examination

7.4. Summative Assessment

- ❖ Ratio of marks in theory and practicals will be equal
- ❖ The pass percentage will be 50%
- ❖ Candidate will have to pass theory and practical examination separately.

A. Theory Examination (Total =400)

	Title	Marks
Paper 1:	Clinical and other Basic Sciences as related to Pharmacology	100
Paper 2:	General & Systemic Pharmacology	100
Paper 3:	Experimental & Clinical Pharmacology	100
Paper 4:	Recent Advances in Pharmacology	100

B. Practical Examination and Viva voce (Total =400)

Sr. No	Exercise	Marks
1	Spotting	40
2	Long Experiment (e.g. bioassay etc.)	60
3	Screening methods (animal models)	40
4	Screening methods (human models)	40
5	Chemical Pharmacology	40
6	Thesis Presentation	40
7	Evaluation of teaching abilities (Microteaching)	40
8.	Viva voce	100

8. Job Responsibilities

- ❖ To maintain a log book on daily basis
- ❖ To maintain daily record of post graduate activities including:
 - Practical exercises
 - Statistics exercises
 - Pharmacokinetic exercises
 - PG teaching schedule
- ❖ To maintain the laboratory equipment allotted to them
- ❖ To prepare and organize undergraduate and postgraduate practicals

9. Suggested Books & Journals**9.1. Core books**

Title of Book	Author
❖ Goodman & Gilman's The Pharmacological Basis of Therapeutics	Goodman and Gilman
❖ Basic and Clinical Pharmacology	BG Katzung
❖ Pharmacology	Rang,Dale, Ritter and Moore

9.2. Reference books

❖ Applied Therapeutics	Kimble, Young, Corelli and Alldredge
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❖ Basic Statistical Methods	Downie and Heath
❖ Clinical Pharmacology	Bennett and Brown
❖ Fundamentals of Experimental Pharmacology	Ghosh M.N.
❖ Principles of Pharmacology	Paul L Munson
❖ Screening Methods	Vogel and Vogel
❖ Text books of Pharmacology	Bowman and Rand

9.3. Monographs

- ❖ Martin Dale's Extra Pharmacopoeia
- ❖ Other Pharmacopoeias

9.4. Journals:

- ❖ Annual Review of Pharmacology and Toxicology
- ❖ British Journal of Pharmacology
- ❖ British Medical Journal
- ❖ Drugs
- ❖ European Journal of Clinical Pharmacology
- ❖ Indian Journal of Pharmacology
- ❖ Japanese Journal of Clinical Pharmacology
- ❖ Journal of Anesthesiology and Clinical Pharmacology
- ❖ Journal of Association of Physicians of India
- ❖ The Lancet
- ❖ The New England Journal of Medicine
- ❖ Trends in Pharmacological Sciences

10. Model Test Papers

MODEL QUESTION PAPER

MD (Pharmacology)
Paper-I

Clinical and other Basic Sciences as related to Pharmacology

*Max. Marks:100**Time: 3 hrs*

-
- **Attempt ALL questions**
 - **Answer each question & its parts in SEQUENTIAL ORDER**
 - **ALL questions carry equal marks**
 - **Illustrate your answer with SUITABLE DIAGRAMS**
-

- I Discuss briefly the status of hormone replacement therapy in post menopausal women.
- II Describe the clinical significance of apoptosis. Discuss the mechanism of action of drugs modifying apoptosis.
- III Discuss the management of nosocomial infections.
- IV Describe the composition of blood substitutes and explain their therapeutic uses.
- V Outline the present status of purinergic receptors.
- VI Describe the pharmacotherapy of obesity.
- VII Define antimicrobial resistance and discuss methods for its prevention.
- VIII Elaborate the modern approaches to receptor characterization and classification.
- IX Discuss the current approaches in the management of osteoporosis.
- X Discuss briefly the pathophysiological basis of the management of essential hypertension with the help of suitable illustrations.

MODEL QUESTION PAPER

MD (Pharmacology)

Paper-II

General & Systemic Pharmacology

*Max. Marks:100**Time: 3 hrs*

-
- **Attempt ALL questions**
 - **Answer each question & its parts in SEQUENTIAL ORDER**
 - **ALL questions carry equal marks**
 - **Illustrate your answer with SUITABLE DIAGRAMS**
-

- I Give an account of the drugs modifying the Renin-angiotensin system. Discuss the clinical implications with special reference to cardiovascular system.
- II Explain the cell-cycle. Discuss the clinical implications of the drugs acting on different phases of cell-cycle.
- III Define selective estrogen receptor modulators. Discuss their therapeutic implications.
- IV Discuss the current therapeutic status of metronidazole in different diseases.
- V Enumerate newer antiepileptic drugs. Discuss their current therapeutic status in seizure and non-seizure disorders.
- VI Classify antidepressant drugs. Give an account of adverse effects of typical and atypical antidepressants.
- VII Discuss the principles of safe and effective antibacterial drug therapy.
- VIII Define half life of a drug following first order kinetics. Discuss its derivation and clinical importance.
- IX Define therapeutic index and discuss its importance in therapeutics.
- X Define pA_2 value. Describe the method of its calculation giving suitable examples.

MODEL QUESTION PAPER

MD (Pharmacology)
Paper-III
Experimental & Clinical Pharmacology

*Max. Marks:100**Time: 3 hrs*

-
- **Attempt ALL questions**
 - **Answer each question & its parts in SEQUENTIAL ORDER**
 - **ALL questions carry equal marks**
 - **Illustrate your answer with SUITABLE DIAGRAMS**
-

- I Define placebo. Give an outline of ethical considerations for its use in clinical trials.
- II Explain the role of genetic engineering in new drug development.
- III Define LD₅₀ and ED₅₀. Discuss the methods for their calculation.
- IV What is the significance of sample size in biomedical research? Give the methods to calculate sample size using an appropriate hypothetical example.
- V Define the term 'transgenic animals'. Elaborate on their use in drug research.
- VI Enumerate the drug schedules. Give a detailed account of Schedule Y.
- VII Discuss the significance of randomization in clinical trials. Elaborate on the practicable methods of randomization.
- VIII Outline the evaluation of diuretic activity of a new compound in animal models.
- IX Discuss the phases of clinical trials. Give an outline of Phase V clinical trial plan.
- X Outline the evaluation of a lead compound for its hypolipidemic activity in animal models.

MODEL QUESTION PAPER

MD (Pharmacology)

Paper-IV

Recent Advances in Pharmacology

*Max. Marks:100**Time: 3 hrs*

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- **Attempt ALL questions**
 - **Answer each question & its parts in SEQUENTIAL ORDER**
 - **ALL questions carry equal marks**
 - **Illustrate your answer with SUITABLE DIAGRAMS**
-

- I Discuss the recent advances in CRIE (Chemotherapy and Radiation Induced Emesis)
- II Define monoclonal antibodies. Describe the rationale for their use in therapeutics.
- III Give an outline of the pathophysiology of bronchial asthma. Discuss the recent advances in its management.
- IV Compare the cyclo-oxygenase enzymes. Discuss the current status of COX-2 inhibitors in therapy.
- V Give an account of pharmacotherapy of cutaneous leishmaniasis.
- VI Describe the ethical considerations for the use of animals in biomedical research. Discuss the alternatives to animal species in research.
- VII Discuss the recent advances in the management of type 2 diabetes mellitus.
- VIII Give a diagrammatic representation of the synthesis of eicosanoids. Describe the newer therapeutic applications of prostaglandins.
- IX Outline the pathophysiology of osteoporosis. Discuss the diagnostic and therapeutic advances in the management of osteoporosis.
- X Describe the management of Premenstrual Dysphoric Disorder.