CHETTINAD ACADEMY OF RESEARCH & EDUCATION
(Deemed to be University under section 3 of the U.G.C. Act 1956)

REGULATIONS & SYLLABUS

M.D. PHARMACOLOGY

CHETTINAD ACADEMY OF RESEARCH AND EDUCATION

CONTENTS

CHETTINAD ACADEMY OF RESEARCH AND EDUCATION

Regulations for M.D. Pre and Para Clinical Courses

1. INTRODUCTION:

M.D. Pre and Para Clinical course is a three year post graduate program under the Faculty of Medicine for students with an Under Graduate Degree in Medicine. This program is a taught course that covers relevant topics and a research project in the area of specialization. This program shall be competence based and learning shall be essentially autonomous and self directed and supplemented with practical and laboratory work. The curriculum shall have modular approach to learning. The research component is through original exploration and experiments culminating in the research project. This program shall impart advanced theoretical and practical aspects of subjects previously studied in a more generalized manner at the undergraduate level.

These courses are aimed at imparting higher level of training to qualified under graduate medical students in various branches of M.D. Pre and Para Clinical subjects and to utilize this learning to the needs of community.

In exercise of the powers conferred under sub rule (a) and (g) of Rule 8 (b) of Memorandum of Association and Clause 2.1, Chapter III of Bye-laws of Chettinad Academy of Research and Education, the Academic Council hereby makes the following regulations:-

2. SHORT TITLE AND COMMENCEMENT:

These Regulations shall be called the "Regulations for M.D. Pre and Para Clinical Courses of Chettinad Academy of Research and Education. These regulations are subject to modifications as may be approved by the Academic Council from time to time.

3. GOAL:

The goal of postgraduate medical education shall be to produce competent specialists and/or medical teachers:

i) who shall recognize the health needs of the community and carry out professional obligations ethically and in keeping with the objectives of the national health policy

ii) who shall have mastered most of the competencies, pertaining to the specialty, that are required to be practiced at the secondary and the tertiary levels of the health care delivery system.
iii) who shall be aware of the contemporary advance and developments in the discipline concerned.
iv) who shall have acquired a spirit of scientific inquiry and is oriented to the principals of research methodology and epidemiology and
v) who shall have acquired the basic skills in teaching of the medical and paramedical professionals.

4. AIMS AND OBJECTIVES:

At the end of the Post Graduate training in the discipline concerned the student shall be able to:

i) Recognize the importance of the concerned speciality in the context of the health needs of the community and the national priorities in the health sector.

ii) Practice the speciality concerned ethically and in step to the principles of primary health care.
iii) Demonstrate sufficient understanding of the basic sciences relevant to the concerned speciality.
iv) Identify social, economic, environmental, biological and emotional determinants of health in a given case, and take them into account while planning therapeutic, rehabilitating, preventive and primitive measures/ strategies.
v) Diagnose and manage majority of the conditions in the speciality concerned on the basis of clinical assessment, and appropriately selected and conducted investigations.
vi) Plan and advise measures for the prevention and rehabilitation of patients suffering from disease and disability related to the speciality.
vii) Demonstrate skills in documentation of individual case details as well as morbidity and mortality rate relevant to the assigned situation.
viii) Demonstrate empathy and human approach towards patients and their families and exhibit interpersonal behavior in accordance with the societal norms and expectations.
ix) Play the assigned role in the implementation of National Health Programme effectively and responsibly.
x) Organize and supervise the chosen/assigned health care services demonstrating adequate managerial skills in the clinic/hospital or the field situation.
xi) Develop skills as a self-directed learner, recognize continuing education needs: select and use appropriate learning resources.
xii) Demonstrate competence in basic concepts of Research Methodology and epidemiology, and be able to critically analyze relevant published research literature.
xiii) Develop skills in using educational methods and techniques as applicable to the teaching of Medical/ Nursing students, General Physicians and Paramedical Health Workers.
xiv) Function as an effective leader of a health team engaged in health care, research or training.

5. COMPONENTS OF THE POSTGRADUATE CURRICULUM:

The major components of the Postgraduate curriculum shall be:

- Theoretical knowledge
- Practical and clinical skills
- Writing Thesis/Research articles
- Attitudes including communication skills
- Training in research methodology, Medical Ethics and Medico legal aspects.

6. NOMENCLATURE OF POSTGRADUATE COURSES:

The nomenclature of Post Graduate Degree should be as laid down in the Post Graduate Medical Education Regulations prescribed by the Medical Council of India.

7. ELIGIBILITY FOR ADMISSION:

Every student, selected for admission to a post graduate medical course in Chettinad University on acquiring M.B.B.S degree or an equivalent qualification thereto shall have obtained permanent registration with the Medical Council of India, or any of the State Medical Council(s) or shall obtain the same within a period of one month from the date of his/her admission, failing which his/her admission shall stand cancelled.

Provided that in the case of a foreign national, the Medical Council of India may, on payment of the prescribed fee for registration, grant temporary registration, for the duration of the post graduate course limited to the medical college/institution to which the candidate is admitted for the time being exclusively for pursuing post graduate studies.

Provided further the temporary registration to such foreign national shall be subject to the condition that such person is duly registered with appropriate registering authority in his own country wherefrom he has obtained his basic medical qualification and is duly recognized by the corresponding Medical Council or concerned authority.

8. RECOGNITION FEE AND ELIGIBILITY CERTIFICATE:

Candidates who have passed the M.B.B.S Degree Examination other than that conducted by Chettinad Academy of Research and Education shall obtain Eligibility Certificate from this University at the time of admission and also remit recognition fee as prescribed.

9. REGISTRATION:

A candidate admitted to the Post Graduate Course shall register with the University by submitting the prescribed application form for registration, duly filled in along with the prescribed fee, through the Head of the Institution.

10. PERIOD OF TRAINING /DURATION OF THE COURSE:

The duration of certified study and training for the M.D. Pre and Para Clinical Courses shall be three completed years including the period of examination.

Provided that in the case of students possessing a recognised two-year postgraduate diploma course in the same subject, the period of training, including the period of examination, shall be two years.

11. COMMENCEMENT OF THE COURSE:

The course shall ordinarily commence from 2nd May of the Academic year.

12. CUT OFF DATES FOR ADMISSION:

Candidates admitted up to 31st May of the Academic year shall be registered for the same Academic Year and shall be eligible to take up the final examination along with others students admitted prior to their admission. There shall be no admission of students in respect of any academic session beyond 31st May for postgraduate courses under any circumstances. The University shall not register any student admitted beyond the said date.

13. SYLLABUS:

The Syllabus for the course shall be as specified in the annexure to these Regulations.

14. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all the subjects of study and for examination.

15. WORKING DAYS / ATTENDANCE *

All the candidates joining the Post Graduate training programme shall work as "Full Time Residents" during the period of training and shall attend not less than 85% (Eighty Five percent) of the imparted training during each academic year including assignments, assessed full time responsibilities and participation in all facets of the educational process as per MCI norms. 85% attendance is compulsory for all the Post Graduate students for every academic year. The Attendance details may be submitted to the Controller of Examinations at the end of every academic year. The student should also be intimated quarterly regarding the lack of attendance.

16. CONDONATION FOR LACK OF ATTENDANCE *

The discretionary power of condonation of shortage of attendance to appear for

University Examination rests with the Vice Chancellor.

Lack of attendance can be condoned up to a maximum of 5% of the minimum attendance Required in the following exceptional circumstances:

(i) Any illness/ accident (for which Medical certificate from a registered medical practitioner must be produced)
(ii) Any unforeseen tragedy in the family (should produce the letter from the parent/guardian)
(iii) Participation in NCC/NSS and other co curricular activities representing the Institution / University. (Certificate from competent authority is required)

For any of the above reasons, request shall be made by the candidate with prescribed fees to the Controller of Examination through proper channel, ten days prior to the commencement of the theory examination. Based on the recommendation of the Head of the Institution, the Controller of Examination shall obtain the approval of the Vice Chancellor for admission of the candidate to the University Examination.

Sl.No.15 & 16 Amended vide XVIII meeting of Academic Council dated 15.04.2014

and to be replaced as detailed below; -

In the existing regulations for M.D. Pre – Para and clinical courses, it has been stipulated that 85% attendance is compulsory for all the Post graduate students for every academic year. This has been modified to 80% attendance in keeping with Statutory Body norms. There shall be no condonation for attendance. The attendance criteria will hence read as follow as in MCI regulations.

"All the candidates joining the Post Graduate training programme shall work as 'Full Time Residents' during the period of training and shall attend not less than 80% (Eighty percent) of the imparted training during each academic year including assignments, assessed full time responsibilities and participation in all facets of the educational process."

The Attendance details shall be submitted to the Controller of Examinations at the end of each academic year. The student should also be intimated quarterly regarding the lack of attendance.

16 (a) STIPEND **AND GRANT OF LEAVE**

The Post Graduate students undergoing Post Graduate Degree / Diploma/Super-Specialty course shall be paid stipend on par with the stipend being paid to the Post Graduate students of State Government Medical Institutions / Central Government Medical Institutions, in the State / Union Territory where the institution is located. Similarly, the matter of grant of leave to Post Graduate students shall be regulated as per the respective State Government rules.

17. MIGRATION / TRANSFER OF CANDIDATES:

Under no circumstances, Migration/transfer of student undergoing any Post Graduate degree course shall be permitted by the University/Authority

18. TRAINING PROGRAMME:

The training given with due care to the Post Graduate students in the recognised institutions for the award of various Post Graduate medical degrees shall determine the expertise of the specialist and / or medical teachers produced as a result of the educational program during the period of stay in the institution.

Every institution undertaking Post Graduate training program shall set up an Academic cell or a curriculum committee, under the chairmanship of a senior faculty member, which shall work out the details of the training program in each speciality in consultation with other department faculty staff and also coordinate and or the implementation of these training Programs.

The training programmes shall be updated as and when required. The structured training programme shall be written up and strictly followed, to enable the examiners to determine the training undergone by the candidates and the Medical Council of India inspectors to assess the same at the time of inspection.

During the training for Post Graduates to be awarded, there shall be proper training in basic medical sciences related to the disciplines concerned; during the training for the degree to be awarded in basic medical sciences, there shall be training in applied aspects of the subject; and there shall be training in allied subjects related to the disciplines concerned. In all Post Graduate training programmes, both clinical and basic medical sciences, emphasis is to be laid on preventive and social aspects and emergency care facilities for autopsies, biopsies, cytopsies, endoscopic and imaging etc. also be made available for training purposes. The Post Graduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.

Training in Medical Audit, Management, Health Economics, Health Information System, basics of statistics, exposure to human behaviour studies, knowledge of pharmaco – economics and introduction to non- liner mathematics shall be imparted to the Post Graduate students.

Implementation of the training programmes for the award of various Post Graduate Degree shall include the following:

Basic Medical Sciences

(i) Lectures, Seminars, Journal Clubs, Group Discussions, Participation in laboratory and experimental work, and involvement in research studies in the concerned speciality and exposure to the applied aspects of the subject relevant to clinical specialities.

(ii) Clinical disciplines

In service training, with the students being given graded responsibilities in the management and treatment of patients entrusted to their care:
participation in seminars, journal clubs, group discussions, clinical Meetings, Grand rounds, and Clinico - Pathological Conferences; practical training in
Diagnosis and medical and Surgical treatment; training in the Basic Medical Sciences, as well as in allied clinical specialities.

The training programme shall be on the same pattern as for M.D. / M.S. in clinical disciplines; practical training including advanced Diagnostic, Therapeutic and Laboratory techniques, relevant to the subject of specialization.

19. MAINTENANCE OF LOG BOOK

a) Every Post Graduate student shall maintain a record (Log) book containing skills, the candidate as acquired during the training period certified by the various heads of department where the candidate as undergone training including outside the institution.

b) The students shall maintain a Record Book (Log Book) of the work carried out by them & training program undergone during the period of training including details of procedures carried out independently or assisted by the candidate. The log book will be checked by the faculty members imparting the training.

c) At the end of the course, the candidate should summarise the contents and get the record (Log) book certified by the Head of the Department.

d) The record (Log) book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.

20.THESIS / DISSERTATION AND EVALUATION

a) All Candidates admitted to undergo M.D. Pre and Para Clinical Courses shall be assigned a topic for dissertation / thesis by the Head of the concerned unit and the title of the topic assigned to the candidates be intimated to the Controller of Examination of the University by the Head of the Department through the Head of the Institution before end of the First year.

b) The dissertation / thesis shall be a bound volume of minimum 50 pages and not exceeding 75 pages of typed matter (double line spacing and on one side only) excluding certification, acknowledgements, annexure and bibliography.

c) Four copies of dissertation shall be submitted six months prior to the commencement of the examination on the prescribed date to the controller of examination of the University.

d) Two copies are to be submitted as an electronic version of the entire dissertation in a standard C.D. format mentioning the details and technicalities used in the C.D. format.

e) The concerned Professors / Readers are to supervise and to see that the dissertation is done properly utilising the clinical materials of their own department / institution. The students must learn the design and interpretation of research studies, responsible use of informed consent and research methodology and interpretation of data and statistical analysis. They should seek the help of qualified staff members in the conduct of research. They must learn to use library and the computer-based research. This training will help them to develop skills in planning, designing and conduct of research studies.

f) All candidates on admission will be allotted one of the department faculties who have fulfilled the requirement to be guides for purposes of guiding Dissertation/thesis. The topic for dissertation shall be finalized and discussed in the departmental faculty meeting and allotted to the individual candidates before the completion of 3 months after admission. The purpose of dissertation is to develop in the candidate the ability to perform an independent study keeping the principles and research methodology in mind. The candidate will therefore work on the prospective problem either within the department or in collaboration with other departments. There will be continuous monitoring of the dissertation work by the guides and co-guide and by the other department staff throughout the course. The candidate will present the progress of the dissertation to the faculty on the completion of 1 ½ years for monitoring and feedback. The completed dissertation should be submitted not later than 6 months before final examination.

g) The theory examinations shall be held sufficiently earlier than the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the start of the Clinical/Practical and Oral examination.

h) The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical. A candidate shall be allowed to appear for Theory and Practical/Clinical examination only after the acceptance of thesis by the examiners. The thesis shall be evaluated under the following heading:
    1) Approved
    2) Not approved

    In all cases the approval shall be given before 3 months of the date of appearing for the examination and this will be essential before the candidate is allowed to appear for the written examination.

21. SCHEDULE OF EXAMINATIONS:

The examination for M.D. Pre and Para Clinical courses shall be held at the end of 3rd academic year. An academic term shall mean six month's training period."

22. SCHEME OF EXAMINATIONS *

Post Graduate Examinations shall consist of Dissertation/Thesis, Written Paper (Theory), Practical and Viva voce.

The examinations shall be organised on the basis of "Marking system" to evaluate and to certify candidate's level of knowledge, skill and competence at the end of the training.

a. ***Dissertation/Thesis*****:** *Every candidate sha*ll carry out and submit a Dissertation/Thesis as explained and approval of Dissertation/Thesis shall be a precondition for a candidate to appear for the final examination.

b. A postgraduate student of a postgraduate degree course would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

c. ***Theory****: A Writt*en Examinati*o*n shall consist of four theory papers each of three hours duration. Each paper carries 100 marks (Total 400 marks). Out of these one shall be of Basic Medical Sciences and one shall be of Recent advances. The theory examinations shall be held well before the Practical examination, so that the answer books can be assessed and evaluated well before the commencement of the Practical and Oral examination.

d. *Practical Examination*:
Practical Examination shall be conducted to test the knowledge and competence of the candidates for making valid and relevant observations based on the experimental / laboratory studies and ability to perform such studies as are relevant to the subject.

e. ***Oral Examination*:** The Oral examination shall be thorough and shall aim at assessing the candidate's knowledge and competence about the subject, investigative procedures, therapeutic technique and other aspects of the speciality, which form a part of the examination.

f. ***Pedagogy*:** Pedagogy to evaluate the communication and teaching skills, and subject knowledge of the student. The topic for Pedagogy will be given at the end of 1st day of the Practical Examination.

THEORY	
No. of Theory Papers	4
Marks for each Theory Paper	*100
Total marks for Theory Papers	400
Passing Minimum for Theory	200/400
Total marks for PRACTICAL	300
Passing Minimum for Practical	150/300
Viva voce	50
Pedagogy	50
Passing minimum for Practical including Viva voce / Pedagogy	200/400

i) If any candidate fails even under one head, he/she has to re-appear for whole examination.
ii) Theory papers consist of 2 essay questions of 25 marks each (2 X 25 = 50) & 5 short notes of 10 marks each (5 X 10 = 50). Total =100 marks each.

***Sl.No.22 (ii) Amended vide XVIII meeting of Academic Council Dated**

15.04.2014 and to be replaced as detailed below:

Resolved to approve 2 Essay Questions (2 x 20 marks) and 10 short notes (10 x 6 marks) for all post graduate medical / broad and higher speciality courses which will take effect for the students appearing for first time examination from March 2015 .

Resolved to approve 2 essays (2 x 20 marks) and 6 short notes (6 x 10 marks) for theory paper in all M. D/ M.S. courses by the Academic Council in its XX meeting held on 25.03.2015.

***Resolved to approve that an examinee should obtain minimum 40% marks in each theory paper and not less than 50% marks cumulatively in all the four papers in P.G. degree examination to be cleared as passed which will be implemented prospectively. (Academic Council in its XX meeting held on 25.03.2015).**

23.EXAMINERS:

All the Post Graduate Examiners shall be recognized Post Graduate Teachers holding recognized post graduate qualification in the subject concerned. For all Post Graduate Examinations, the Minimum number of examiners shall be Four, out of which at least two (50%) shall be external examiners who shall be invited from other recognized universities from outside the state / outside university. The remaining two will be internal examiners.

The qualification and teaching experience for appointment of examiner shall be as detailed below and by the guidelines of Medical Council of India issued from time to time.

No person shall be appointed as an internal examiner in any subject unless he/she has three years experience as recognized PG teacher in the concerned subject. For external examiners, he/she should have minimum six years of experience as recognized PG teacher in the concerned subject'. "An examiner shall ordinarily be appointed for not more than two consecutive terms"

Under exceptional circumstances, examinations may be held with 3 (three) examiners provided two of them are external and Medical Council of India is intimated for the justification of such action prior to publication of result for approval. Under no circumstances, result shall be published in such cases without the approval of Medical Council of India.

24. MAXIMUM NUMBER OF CANDIDATES:

The maximum number of candidates to be examined in clinical/practical and oral on any day shall not exceed eight for M.D. Pre and Para Clinical Courses.

25.*NUMBER OF EXAMINATIONS:

The University shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations. The examination shall be conducted in September and March.

***Sl. No.25 Amended in XXI meeting of Academic Council dated 22.07.2015**

Resolved to approve the commencement of M.D. /M.S. University examination in April (for Regular Batch) and October (for Supplementary Batch).

26. REVALUATION OF ANSWER PAPERS:

There shall be no revaluation of answer papers. However, re-totaling is allowed in the failed subjects with the payment of required fee fixed by the University within 15 days from the date of receipt of statement of marks.

SYLLABUS for MD PHARMACOLOGY (2011-12 onwards)
***Syllabus amended in academic year 2017-18(pg. no.174)**

1) Goal

The overall goal of the course is to develop expertise in the field of Pharmacology and rational approach to drug development and therapy so that he/she shall be competent to pursue various activities as demanded by the profession as a Pharmacologist.

2) Objectives:

At the end of the course the student should be able to

a) Have a holistic knowledge of the source, chemical structure, actions, mechanisms, adverse effects and pre clinical and clinical evaluation of t the various drugs used and drugs to be used in therapy
b) Teach Pharmacology effectively to the students of Under graduate & post graduate Medical, Paramedical and other related courses
c) Evaluate the drug effects in animals and humans
d) Carry out research in this area to further the development of new drugs
e) Collect and analyze experimental and clinical data related to drug kinetics or dynamics
f) To use advanced teaching methods and facilitate computer aided learning
g) To know the regulatory guidelines in drug testing, patent laws and procedures etc.

3) Justification/ Need for the program:

It is well known that there is shortage of pharmacology faculty in all the teaching medical institutions throughout India. More over there is an increase in the number of medical colleges- both government & private. But the number of medical teachers available is far from adequate to meet the deficiency of faculty in medical colleges. Hence offering M.D Pharmacology course will provide faculty to meet this deficiency. In addition, the student after

completion of M.D Pharmacology can be employed in Pharmaceutical industries for new drug development.

Moreover, an in-depth knowledge in pharmacology will help the Medical practitioners to prescribe rationally and effectively.

CORE SYLLABUS

	TITLE OF THE PAPER
Paper I	**General Pharmacology, Experimental Pharmacology & Research methodology including biostatistics**
Paper II	**Applied Pharmacology & therapeutics**
Paper III	**Clinical pharmacology and clinical research including Ethics**
Paper IV	**Systemic Pharmacology including Recent Advances**

4) Curriculum of the course:

Duration: 3 years

1st year: First 3months – orientation course in which the student learns about the ethical principles and guide lines for biomedical research, research methodology, biostatistics, teaching methodology and computer applications

Next 6 months – clinical postings in rotation to different departments. In addition, they will learn general and experimental and biochemical pharmacology. Dissertation topic will be selected with in the first 6 months, finalized within 9 months and communicated to the COE before the end of first year

2nd year: The student will start the dissertation work. Simultaneously he/she will learn systemic pharmacology including recent advances, clinical pharmacology and clinical trial process including ethical and regulatory guidelines.

3rd year: The student will complete the dissertation work 6 months before the schedule date of university examination. Paper on applied pharmacology and therapeutics will be dealt with in this year.

Paper I – General Pharmacology, Experimental Pharmacology & Research methodology including biostatistics

In this paper the student will learn in depth general pharmacology with special emphasis to assessment of pharmacokinetic parameters and pharmaco dynamic evaluation.

General pharmacology

- History of medicine, Introduction of a new drug - drug discovery & development
- Pharmacological terms, Sources of drug

- Routes of drug administration - targeted and novel drug delivery systems
- Pharmacokinetics -Drug absorption, drug transporter families, factors affecting drug absorption, bioavailability distribution, compartment models, drug metabolism-microsomal and non microsomal, enzyme inducers & inhibitors including xenobiotics
- Drug excretion – routes, kinetics of elimination, half life
- Pharmacodynamics -Mechanism of drug action – receptor and non receptor mediated, receptor regulation – up and down regulation, rebound phenomenon, withdrawal syndrome, therapeutic index, therapeutic window, dose response relation ship
- Factors modifying drug action – drug related – patient related, ADRs& interactions Pharmacovigilance
- Introduction to drug discovery and development & clinical trials – types, phases and regulations in brief.

Experimental Pharmacology

- Introduction to pre clinical research and lab animals: Introduction to preclinical research - Lab animals – Breeding and maintenance, General characteristics of and experiments done with - Frogs, Mice, Rats, Rabbits, Hamsters and guinea pigs– Monkeys, Horses, Sheep, Chimpanzees, Apes and chicks –Animal house and CPCSEA guidelines,
- Routes of drug administration, Feeding Techniques, Samples and Methods of sampling –blood, urine and others–Techniques of making animals unconscious, euthanasia and disposal of animals. ICH guidelines for animal experiments & GLP
- Toxicology studies: Instruments and Equipment for animal studies –Toxicology studies-Introduction and acute toxicity–Sub acute and chronic toxicity – Reproductive toxicity -Carcinogenicity –Mutagenicity, Immuno toxicity -Neurotoxicity and others – Toxicokinetics and Bioassay & Schedule Y .

Animal testing.

- Physiological salt solutions, drugs – standard & test, anaesthetics
- Mice - analgesics, CNS stimulants & depressants, Psychopharmacological Study, Skeletal Muscle Relaxants & others
- Rat- Tail vein injection, Psychopharmacological Study, Analgesics and others
- Rabbit –Ear vein injection, Mydriatics, Miotics, Local anaesthetics & Langendorff's preparation
- Guinea pig - Ileum – Finkleman method, Local Anaesthetics, Histamine aerosol method
- Frog - Rectus, failing heart, Oesophagus, Local Anaesthetics.
- Bioassay, Rat experiments using Colon, fundus of stomach, Uterus, & Mice experiments

Biochemical Pharmacology

- Identification and estimation of drugs by chemical tests. and HPLC
- Toxicological Study – spectrophotometer, HPLC, calorimeter and autoanalyser, Hormonal Estimation.
- Biochemical Methods – Liver Function Test – SGOT, SGPT, Kidney Function Test-

  auto analyser - Clinical Methods - Interpretation of laboratory data

Research methodology including biostatistics

- Research Methodology

  Introduction, Research Methods, Research questions, Literature review, Theoretical frame works or model, drawing up of protocol, framing Objectives, selection of study population, Data collection, Presentation of data.

- Bio Statistics:

  Statistical methods: Introduction, Presentation of statistical data, Statistical averages (Mean, Median & Mode), Standard Deviation, Normal distribution, parametric & non parametric test, Test for significance & Chi square test.

Teaching Methodology & Computer applications

Student will attend the workshop on Teaching Methodology & Computer applications

Note:

In addition to the paper given above the students will be posted to the clinical departments in rotation for a period of six months.
They will also carry out teaching duties. Tentative dissertation topic will be selected.

Paper II - Applied Pharmacology & therapeutics

Applied Pharmacology

- Selection of drug – p drug concept - Formulation, dosage, - combinations – Pharmaco economics – pharmacovigilance – Pharmacogenetics & genomics – pharmacoepidemiology- Rational drug use – prescription writing - Critical Evaluation of prescriptions, Clinical Problem solving, Critical analysis of Data, Critical evaluation of journal articles
- Drug information unit
- Drugs in pregnancy, lactation- paediatric pharmacology- geriatric pharmacology- drugs& sports

Medical Writing

- Writing medical manuscripts - proposal writing - Preparation of protocol – Proforma - ICF – SOP

Paper III - Clinical pharmacology and clinical research including Ethics

Clinical Pharmacology

- BABE studies - Clinical parameters- half life, clearance, AUC, Calculations of pharmacokinetic parameters

Clinical research including Ethics

- Introduction to drug discovery and development
- Introduction to drug discovery - drug discovery and development process -– disease target identification – Genomics – Proteomics – Metabolomics- Enzymes as targets – MM equation- Formulations & Pre formulations –Biosimilars - bio informatics- introduction and drug development tools.
- Introduction to Clinical Research
- Introduction to research- types of research- clinical research- essential terminologies –Types of clinical trials - Scope of clinical trials - Benefits and risks of participating in a clinical trial – Team involved in clinical trial – features and components of various phases of clinical trials
- Ethics in Clinical research
- Ethics- Introduction- ethics in biomedical research- Historical development- Nuremberg code- Belmont report- Declaration of Helsinki- ICMR guidelines - Roles and responsibilities of IRB/IEC - informed consent. GCP – Indian GCP - comparative guidelines

Paper IV - Systemic Pharmacology including Recent Advances

- **Autonomic Nervous system**
- Anatomical distribution, physiological actions – cholinergic system – receptors and actions, anticholinergics, clinical applications; adrenergic system – receptors and actions – clinical applications, adrenergic blockers – alpha and beta blockers - Evaluatory methods of autonomic drugs.

- **Cardiovascular Drugs**
- Cardiac physiology - Myocardial ischemia – pathophysiology - nitrates– Calcium channel blockers –Beta blockers–vasodilators - Drugs used in CCF and Hypertension - Antiarrhythmic drugs - Drugs for Hypercholesterolemia –Evaluation of cardiovascular drugs
- **Drugs acting on Kidney**
- Renal anatomy and physiology –Diuretics: ––anti Diuretics - Renin angiotensin system - ACE inhibitors and Receptor antagonists -Evaluation of drugs acting on kidney
- **Autacoids and Related drugs**

- Histamine and antihistamines –5HT- Agonists and Antagonists- Eicosanoids - Prostaglandins –NSAIDS-anti rheumatoid- anti-gout agents -leukotrienes and antagonist -Nitric oxides – other autacoids –evaluation of Anti histamines- anti-inflammatory , antipyretic and analgesics

- **Respiratory system Drugs**
- Drugs in asthma & cough – Evaluation of antitussives & antiasthmatics

- **Drugs acting on Central nervous system.**
- Introduction to CNS and Neurotransmitters - Sedatives and hypnotics – anti anxiety drugs- Antiepileptics – General Anesthetics -– Alcohols- Anti psychotics - Anti depressants and Antimanic drugs -Anti parkinsonians - Opioids – drugs used in neuro degenerative disorders – Evaluations of CNS stimulants - CNS depressants – Antipsychotics - Anti anxiety drugs – anti depressants – anti parkinsonian and Alzhimers Disease
- **Peripheral nervous system**
- Local Anesthetics – Skeletal muscle relaxants – Evaluation of local anesthetics & skeletal muscle relaxants

- **Drugs affecting blood and blood formation**
- Anemia- iron deficiency, maturation factors – coagulants and anti coagulants – antiplatelets, antithrombotic and fibrinolytic drugs -Evaluation of coagulants & anticoagulants
- **Gastro intestinal Drugs**
- GIT- Emetics and anti emetics-drugs used in peptic ulcer, constipation & Diarrhea – inflammatory bowel disease & irritable bowel syndrome - Evaluation of peptic ulcer – drugs altering gut motility

- **Hormones and related Drugs**

- Pituitary hormones, Female sex hormones in health & disease - Contraceptives –drugs used in infertility - Evaluation of fertility drugs -Male sex hormones – Androgens & antiandrogens, anabolic steroids-Thyroid and anti thyroid drugs - Corticosteroids - Insulin- Oral hypoglycemic - evaluation of anti diabetics- drugs affecting calcium metabolism

- **Antimicrobial Drugs**
- Introduction - Beta lactum antibiotics - Penicillins–Cephalosporins- Broad spectrum, Macrolides and others- Quinolones and sulfonamides - Amino glycosides - Anti TB - Anti leprosy - Anti malarial - Anti fungal - Anti viral –Anti protozoals - Anti parasites.& Disinfectants & Antiseptics- evaluation of anti microbial agents
- **Drugs used in Neoplastic Diseases & evaluation methods**
- **Miscellaneous Drugs.**
- Immuno pharmacology –– Vitamins - Vaccines – therapeutic gases - Neutraceutics – probiotics –-selected herbal products- Dermatopharmacology including cosmoceuticals & ocular pharmacology
- Toxicology –poisoning – heavy metals& antagonists- environmental & occupational toxicans- non-organophasphorous poisoning

Note: All the chapters will include the recent advances

Pattern of Question Paper

2 Essays (Each 25 marks)	50 marks
5 short notes (Each 10 marks)	50 marks
Total	**100 marks**

Practical Exam

	Day I	Marks
1	Long Animal Experiment	100
2	Isolated Tissue Experiment including bioassay	100
	Total	**200**
	DAY II	
3	Short Experiments Technique demonstration Instruments used in experimental Pharmacology, Oral feeding, I.V. Injection Clinical Pharmacology	50 25 25
4.	Pedagogy	50 marks
5.	Viva	50marks
	Total Marks DayII	**200Marks**
	Total marks (Day I & Day II)	**400 marks**

Scheme of mark distribution

SNo	Experiment	Maximum marks	Minimum marks
1	Written Exam (4x100)	400	200
2	Viva	50]	
3	Pedagogy	50]	
4	Practical	300]	200

List of Books

Paper I – General Pharmacology, Experimental Pharmacology & Research methodology including biostatistics

Text books

1. Pharmacology – H.P.Rang and M.M. Dale
2. Basics and Clinical pharmacology – katzung
3. Pharmacology Pharmacotherapeutics – R.S Sathoskar,S.B.Bhandarkar, S.S Ainapure & H.R. Sathoskar
4. H.Gerhard Vogle " Drug Discovery and Evaluation"
5. Goodman & Gilman's "The Pharmacological basis of therapeutics"
6. Harrison's principles of internal medicine 6th edition
7. Davidson's principles & practice of medicine 20th edition
8. Selected topics in Experimental Pharmacology – U.K Sheth, N.K. Dadkar and Usha G Kamat
9. Fundamentals of Experimental Pharmacology – M.N.Ghosh
10. Screening Methods in Pharmacology – Robert Turner
11. Introduction to biostatistics and Research methods - P.S. Sundar Rao, J. Richard
12. Basics Statistics and Pharmaceutical Statistical Application - James E. De Muth
13. CIMS

14. MIMS
15. TDR

Paper II - Applied Pharmacology
Text books

1. Goodman & Gilman's "The Pharmacological basis of therapeutics"
2. Selected topics in Experimental Pharmacology – U.K Sheth, N.K. Dadkar and Usha G Kamat
3. Fundamentals of Experimental Pharmacology – M.N.Ghosh
4. Screening Methods in Pharmacology – Robert Turner
5. Pharmaceutical dosage forms and drug delivery systems, 8th edition, by Loyd V.Allen,Nicholas C. popovich and Howard C. Ansel
6. Harrison's principles of internal medicine 6th edition
7. Davidson's principles & practice of medicine 20th edition

Paper III - Clinical pharmacology and clinical research including Ethics

Text books

1. Pharmaceutical dosage forms and drug delivery systems, 8th edition, by Loyd V.Allen,Nicholas C. popovich and Howard C. Ansel
2. The Belmont Report, Ethical Principles and Guidelines for the Protection of Human Subjects of Research. The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research April 18, 1979.
3. World medical association declaration of Helsinki. Ethical principles for medical research involving human subjects
4. Ethical guidelines For Biomedical research On Human participants, Indian council of medical research New Delhi, Published by Director-General Indian Council of Medical Research New Delhi. www.icmr.nic.in

Paper IV - Systemic Pharmacology including Recent Advances
Text books

1. Pharmacology – H.P.Rang and M.M. Dale
2. Basics and Clinical pharmacology – katzung
3. Pharmacology Pharmacotherapeutics – R.S Sathoskar,S.B.Bhandarkar, S.S Ainapure & H.R. Sathoskar
4. Goodman & Gilman's "The Pharmacological basis of therapeutics"
5. Selected topics in Experimental Pharmacology – U.K Sheth, N.K. Dadkar and Usha G Kamat
6. Fundamentals of Experimental Pharmacology – M.N.Ghosh
7. Screening Methods in Pharmacology – Robert Turner

Change in Examination paper titles of M.D. Pharmacology 2017 batch onwards as approved by the Academic Council in its XXVIII Meeting held on 17.11.2017

Department of Pharmacology - CHRI

MD PHARMACOLOGY

1) Title of the program : M.D. Pharmacology
2) Level of the Program: Post graduate degree
3) Duration of program: 3 years
4) Duration of Internship (If any) – Nil
5) Intake capacity : 4 students
6) Program pattern - Non Semester
7) Eligibility Criteria for Admssion: MBBS
8) Syllabus of the course: Attached
9) Evaluation pattern
   Examination at university level: At the end of the course
10) Mode of Selection: Based on entrance exam and interview

11) Goal

The overall goal of the course is to develop expertise in the field of Pharmacology and rational approach to drug development and therapy so that he/she shall be competent to pursue various activities as demanded by the profession as a Pharmacologist.

12) Objectives:

At the end of the course the student should be able to

a) Have a holistic knowledge of the source, chemical structure, actions, mechanisms, adverse effects and pre clinical and clinical evaluation of t the various drugs used and drugs to be used in therapy.
b) Teach Pharmacology effectively to the students of Under graduate & post graduate Medical, Paramedical and other related courses.
c) Evaluate the drug effects in animals and humans
d) Carry out research in this area to further the development of new drugs
e) Collect and analyze experimental and clinical data related to drug kinetics or dynamics
f) Use advanced teaching methods and facilitate computer aided learning
g)Know the regulatory guidelines in drug testing, patent laws and procedures etc.
h) Implement rational drug use
i) Publish the research work
j) Communicate effectively the essential details of drugs prescribed to the patients.

3) Justification/ Need for the program:

It is well known that a sound knowledge of pharmacology is essential for rational treatment of diseases. The pharmacologists are the experts who can help clinicians to prescribe drugs optimally and rationally. In this regard offering this course would contribute to improvement in pharmacotherapeutics and ultimately the well being of patients. Moreover this course is an approved one by MCI. In addition the student after completion of M.D. Pharmacology can be employed in Pharmaceutical industries for new drug development.

CORE SYLLABUS

YEAR	TITLE OF THE PAPER
I year	General Pharmacology
	Experimental Pharmacology
	Research methodology and biostatistics
	Teaching methodology & computer applications
	Clinical posting – 6 months
	Dissertation work
II year	Systemic Pharmacology
	Clinical Pharmacology
	Clinical Research including Ethics
	Introdcution to patent laws
	Dissertation work
	Poster and oral presentation
III year	Applied Pharmacology and recent advances
	Submission of Dissertation
	Publication of research work

14) Curriculum of the course:

Duration: 3 years

1st year: First 6 months – orientation course in which the student learns about the ethical principles and guide lines for biomedical research, research methodology, biostatistics, teaching methodology and computer applications along with General pharmacology. The research topic will be selected by the candidate before 90 days as mandated by the university guidelines.

Next 6 months – clinical postings in rotation to different departments. In addition students will learn general and experimental and biochemical pharmacology.

2nd year: The student will start the dissertation work. Simultaneously he/she will learn systemic pharmacology including recent advances, clinical pharmacology and clinical trial process including ethical and regulatory guidelines.

3rd year: The student will complete the dissertation work 6 months before the schedule date of university examination. Paper on applied pharmacology and recent advances will be dealt with in this year.

Resolutions passed by the Academic Council in its XXVIII Meeting held on 17.11.2017

9. Change in Examination paper titles of M.D. Pharamcology.

Syllabus for M.D Pharmacology

I Year

Paper I – General Pharmacology, Experimental Pharmacology & Research methodology including biostatistics

In this paper the student will learn in depth general pharmacology with special emphasis to assessment of pharmacokinetic parameters and pharmaco dynamic evaluation. The student will be given adequate training in Research methodology and biostatistics.

General pharmacology

History of medicine, Introduction of a new drug - drug discovery & development
Pharmacological terms, Sources of drug
Routes of drug administration - targeted and novel drug delivery systems
Pharmacokinetics -Drug absorption, drug transporter families, factors affecting drug absorption, bioavailability distribution, compartment models, drug metabolism-microsomal and non microsomal, enzyme inducers & inhibitors including xenobiotics
Drug excretion – routes, kinetics of elimination, half life
Pharmacodynamics -Mechanism of drug action – receptor and non receptor mediated, receptor regulation – up and down regulation, rebound phenomenon, withdrawal syndrome, therapeutic index, therapeutic window, dose response relation ship
Factors modifying drug action – drug related – patient related, ADRs& interactions Pharmacovigilance
Introduction to drug discovery and development & clinical trials – types, phases and regulations in brief.

Experimental Pharmacology

Introduction to pre clinical research and lab animals: Introduction to preclinical research - Lab animals – Breeding and maintenance, General characteristics of and experiments done with - Frogs, Mice, Rats, Rabbits, Hamsters and guinea pigs–Monkeys, Horses, Sheep, Chimpanzees, Apes and chicks –Animal house and CPCSEA guidelines,

Routes of drug administration, Feeding Techniques, Samples and Methods of sampling –blood, urine and others–Techniques of making animals unconscious, euthanasia and disposal of animals. OECD, ICH guidelines for animal experiments & GLP.

Toxicology studies: Instruments and Equipment for animal studies –Toxicology studies- Introduction and acute toxicity–Sub acute and chronic toxicity – Reproductive toxicity - Carcinogenicity –Mutagenicity, Immuno toxicity -Neurotoxicity and others –Toxicokinetics and Bioassay & Schedule Y

Animal testing procedures

Physiological salt solutions, drugs – standard & test, anaesthetics
Mice - analgesics, CNS stimulants & depressants, Psychopharmacological Study, Skeletal Muscle Relaxants & others
Rat- Tail vein injection, Psychopharmacological Study, Analgesics, anti inflammatory agents,anti diabetic studies and others.
Rabbit –Ear vein injection, Mydriatics, Miotics, Local anaesthetics & Langendorff's preparation

Guinea pig - Ileum – Finkleman method, Local Anaesthetics, Histamine aerosol method
Frog - Rectus, failing heart, Oesophagus, Local Anaesthetics.
Bioassay, Rat experiments using Colon, fundus of stomach, Uterus, & Mice experiments

Biochemical Pharmacology
Identification and estimation of drugs by chemical tests. and HPLC
Toxicological Study – spectrophotometer, HPLC, calorimeter and autoanalyser, Hormonal Estimation.
Biochemical Methods – Liver Function Test – SGOT, SGPT, Kidney Function Test- auto analyser - Clinical Methods - Interpretation of laboratory data

Research methodology including biostatistics

Research Methodology

Introduction, Research Methods, Research questions, Literature review, Theoretical frame works or model, drawing up of protocol, framing Objectives, selection of study population, Data collection, Presentation of data.

Bio Statistics:
Statistical methods: Introduction, Presentation of statistical data, Statistical averages (Mean, Median & Mode), Standard Deviation, Normal distribution, parametric & non parametric test, Test for significance & Chi square test.

Teaching Methodology & Computer applications

Student will attend the workshop on Teaching Methodology & Computer applications

In addition to the paper given above the students will be posted to the clinical departments in rotation for a period of six months.
They will also carry out teaching duties. Tentative dissertation topic will be selected.

II year

Paper II – Systemic Pharmacology
Autonomic Nervous system
Anatomical distribution, physiological actions – cholinergic system – receptors and actions, anticholinergics, clinical applications; adrenergic system – receptors and actions – clinical applications, adrenergic blockers – alpha and beta blockers - Evaluatory methods of autonomic drugs.

Cardiovascular Drugs
Cardiac physiology - Myocardial ischemia – pathophysiology - nitrates– Calcium channel blockers –Beta blockers–vasodilators - Drugs used in CCF and Hypertension - Antiarrhythmic drugs - Drugs for Hypercholesterolemia –Evaluation of cardiovascular drugs

Drugs acting on Kidney
Renal anatomy and physiology –Diuretics: ––anti Diuretics - Renin angiotensin system - ACE inhibitors and Receptor antagonists -Evaluation of drugs acting on kidney

Autacoids and Related drugs

Histamine and antihistamines –5HT- Agonists and Antagonists- Eicosanoids -Prostaglandins – NSAIDS-anti rheumatoid- anti-gout agents -leukotrienes and antagonist -Nitric oxides – other autacoids –evaluation of Anti histamines- anti-inflammatory , antipyretic and analgesics

Respiratory system Drugs
Drugs in asthma & cough – Evaluation of antitussives & antiasthmatics

Drugs acting on Central nervous system.
Introduction to CNS and Neurotransmitters - Sedatives and hypnotics – anti anxiety drugs- Antiepileptics – General Anesthetics -– Alcohols- Anti psychotics - Anti depressants and Antimanic drugs -Anti parkinsonians - Opioids – drugs used in neuro degenerative disorders – Evaluations of CNS stimulants - CNS depressants – Antipsychotics - Anti anxiety drugs – anti depressants – anti parkinsonian and Alzhimers Disease

Peripheral nervous system
Local Anesthetics – Skeletal muscle relaxants – Evaluation of local anesthetics & skeletal muscle relaxants.

Drugs affecting blood and blood formation
Anemia- iron deficiency, maturation factors – coagulants and anti coagulants – antiplatelets, antithrombotic and fibrinolytic drugs -Evaluation of coagulants & anticoagulants.

Gastro intestinal Drugs
GIT- Emetics and anti emetics-drugs used in peptic ulcer, constipation & Diarrhea – inflammatory bowel disease & irritable bowel syndrome - Evaluation of peptic ulcer – drugs altering gut motility.

Hormones and related Drugs

Pituitary hormones, Female sex hormones in health & disease - Contraceptives –drugs used in infertility - Evaluation of fertility drugs -Male sex hormones – Androgens & antiandrogens, anabolic steroids-Thyroid and anti thyroid drugs - Corticosteroids - Insulin- Oral hypoglycemic - evaluation of anti diabetics- drugs affecting calcium metabolism

Antimicrobial Drugs

Introduction - Beta lactum antibiotics - Penicillins–Cephalosporins- Broad spectrum, Macrolides and others- Quinolones and sulfonamides - Amino glycosides - Anti TB - Anti leprosy - Anti malarial - Anti fungal - Anti viral –Anti protozoals - Anti parasites.& Disinfectants & Antiseptics- evaluation of anti microbial agents.

Drugs used in Neoplastic Diseases & evaluation methods
Miscellaneous Drugs.

Immuno pharmacology –– Vitamins - Vaccines – therapeutic gases - Neutraceutics – probiotics –-selected herbal products- Dermatopharmacology including cosmoceuticals & ocular pharmacology
Toxicology –poisoning – heavy metals& antagonists- environmental & occupational toxicans- non-organophasphorous poisoning

Paper III - Clinical pharmacology and clinical research including Ethics

Clinical Pharmacology

BABE studies - Clinical parameters- half life, clearance, AUC, Calculations of pharmacokinetic parameters.

Clinical research including Ethics
Introduction to drug discovery and development

Introduction to drug discovery - drug discovery and development process -– disease target identification – Genomics – Proteomics – Metabolomics- Enzymes as targets – MM equation- Formulations & Pre formulations –Biosimilars - bio informatics- introduction and drug development tools.

Introduction to research:- types of research- clinical research- essential terminologies – Types of clinical trials - Scope of clinical trials - Benefits and risks of participating in a clinical trial – Team involved in clinical trial – features and components of various phases of clinical trials

Ethics in Clinical research

Ethics- Introduction- ethics in biomedical research- Historical development- Nuremberg code- Belmont report- Declaration of Helsinki- ICMR guidelines - Roles and responsibilities of IRB/IEC - informed consent. GCP – Indian GCP - comparative guidelines

III year
Paper IV - Applied Pharmacology & Recent advances

Applied Pharmacology

Selection of drug – p drug concept - Formulation, dosage, - combinations – Pharmaco economics – pharmacovigilance – Pharmacogenetics & genomics –pharmacoepidemiology- Rational drug use – prescription writing - Critical Evaluation of prescriptions, Clinical Problem solving, Critical analysis of Data, Critical evaluation of journal articles – CONSORT-STROBE-TREND-ARRIVE and other guidelines
Drug information unit
Drugs in pregnancy, lactation- paediatric pharmacology- geriatric pharmacology- drugs& sports

Medical Writing

Writing medical manuscripts - proposal writing - Preparation of protocol – Proforma - ICF– SOPs

Recent advances in therapeutics

Dissertation works

SCHEME OF EXAMINATION

Internal Assessment 100 marks

University Examination

4 Theory papers – 100 marks each paper = 400 marks
Passing minimum 50% = 200 marks
Practical – 300 marks
Passing minimum 50% = 150 marks
Viva voce – 50 marks

Pedagogy – 50 marks
Total maximum marks = 800 marks

Final Qualifying Exam – At the end of 3rd year
Dissertation work should be completed & submitted 6 months before examination. Students will be eligible to take up the university examination only if the **dissertation** is approaved, presented **one poster, oral presentation and publication** as prescribed in the university g uidelines.

Pattern of Question Paper

2 Essays (Each 25 marks)	50 marks
5 short notes (each 10 marks)	50 marks
Total	**100 marks**

Practical Exam

Day I		
1	HPLC experiment	75 marks
2	Chemical Test followed by discussion	50 marks
3	Animal handling	10 marks
4	Pharmacokinetic calculations	40 marks
5	Instrumentation	30 marks
DAY II		
6	Medical writing	30 marks
	Protocol	
7	ICF/SOP	25 marks
8.	Pharmacovigilance	25 marks
9.	Journal criticism	15 marks
10.	Pedagogy	50 marks
11.	Grand Viva	50 marks
	Total marks	**400 marks**

Scheme of mark distribution

SNo	Experiment	Maximum marks	Minimum marks
1	Written Exam (4x100)	400	200
2	Viva	50	
3	Pedagogy	50	
4	Practical	300	150
5	Viva + theory	450	225
6	Practical + pedagogy	350	175

7	Total	800	400

List of Books

Paper I – General Pharmacology, Experimental Pharmacology & Research methodology including biostatistics

Text books

1. Pharmacology – H.P.Rang and M.M. Dale, JM Ritter, PK Moore, Elsevier.
2. Basics and Clinical pharmacology – katzung
3. Pharmacology Pharmacotherapeutics – R.S Sathoskar,S.B.Bhandarkar, Nirmala N. Rege, Popular Prakashan Pvt. Ltd.2010.
4. H. Gerhard Vogle "Drug Discovery and Evaluation"
5. Goodman & Gilman's "The Pharmacological basis of therapeutics" Laurence L Brunton, John S Lazo, Keith L Parker.
6. Harrison's principles of internal medicine. Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, McGraw Hill.
7. Davidson's principles & practice of medicine
8. Selected topics in Experimental Pharmacology – U.K. Sheth, N.K. Dadkar and Usha G Kamat.
9. Fundamentals of Experimental Pharmacology – M.N. Ghosh
10. Screening Methods in Pharmacology – Robert Turner, Gupta and Gupta
11. Introduction to biostatistics and Research methods - P.S. Sundar Rao, J. Richard
12. Basics Statistics and Pharmaceutical Statistical Application - James E. De Muth
13. CIMS
14. MIMS
15. TDR
16. Medical Pharmacology, SK Srivastava, Avichal publishing company.
17. Drug discovery, Shayne Cox Gad, Wiley inter science, New Jersy.
18. Clinical Pharmacology and rational therapeutics, PV Rataboli, Ane books pvt. Ltd.,

Paper II - Systemic Pharmacology
Text books

1. Pharmacology – H.P.Rang and M.M. Dale
2. Basics and Clinical pharmacology – katzung
3. Pharmacology Pharmacotherapeutics – R.S Sathoskar,S.B.Bhandarkar, S.S Ainapure & H.R. Sathoskar
4. Goodman & Gilman's "The Pharmacological basis of therapeutics"
5. Selected topics in Experimental Pharmacology – U.K Sheth, N.K. Dadkar and Usha G Kamat
6. Fundamentals of Experimental Pharmacology – M.N.Ghosh
7. Screening Methods in Pharmacology – Robert Turner
8. Medical Pharmacology, SK Srivastava, Avichal publishing company.

Paper III - Clinical pharmacology and Clinical research including Ethics

Text books

1. Clinical Pharmacology, PN Bennet, MJ Brown
2. Pharmaceutical dosage forms and drug delivery systems by Loyd V. Allen, Nicholas C. popovich and Howard C. Ansel
3. The Belmont Report, Ethical Principles and Guidelines for the Protection of Human Subjects of Research. The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research April 18, 1979.
4. World medical association declaration of Helsinki. Ethical principles for medical research involving human subjects
5. Ethical guidelines For Biomedical research On Human participants, Indian council of medical research New Delhi, Published by Director-General Indian Council of Medical Research New Delhi. www.icmr.nic.in
6. Textbook of Clinical Trials, David Machin(Editor), Simon Day (Co-Editor), Sylvan Green (Co- Editor), ISBN: 978-0-470-01014-3. November 2006

Paper IV- Applied Pharmacology and Recent advances

Text books

1. Goodman & Gilman's "The Pharmacological basis of therapeutics"
2. Selected topics in Experimental Pharmacology – U.K Sheth, N.K. Dadkar and Usha G Kamat
3. Fundamentals of Experimental Pharmacology – M.N.Ghosh
4. Screening Methods in Pharmacology – Robert Turner
5. Pharmaceutical dosage forms and drug delivery systems, 8th edition, by Loyd V.Allen,Nicholas C. popovich and Howard C. Ansel
6. Harrison's principles of internal medicine
7. Davidson's principles & practice of medicine
8. For recent advances Journals and online portals.

Journals recommended for reading

Indian

1. Indian Journal of Pharmacology
2. Indian Journal of Physiology and Pharmacology
3. BMJ Indian Edition
4. Indian journal of medical ethics

International

1. Journal of experimental pharmacology
2. TIPS
3. Year book of pharmacology
4. British journal of clinical pharmacology
5. American journal of clinical pharmacology
6. Journal of ethno pharmacology
7. Lancet
8. Journal of Clinical Pharmacology