SHRI
DHARMASTHALA
MANJUNATHESHWARA
UNIVERSITY

TRUTH LIBERATES

Ordinance Governing
MD PHARMACOLOGY
Curriculum 2019-20

SHRI DHARMASTHALA MANJUNATHESHWARA UNIVERSITY

(A State Private University established under the Shri Dharmasthala Manjunatheshwara University
Act No 19 of 2018 of Government of Karnataka and Notification No. ED 261 URC 2018 dated 19th December 2018)

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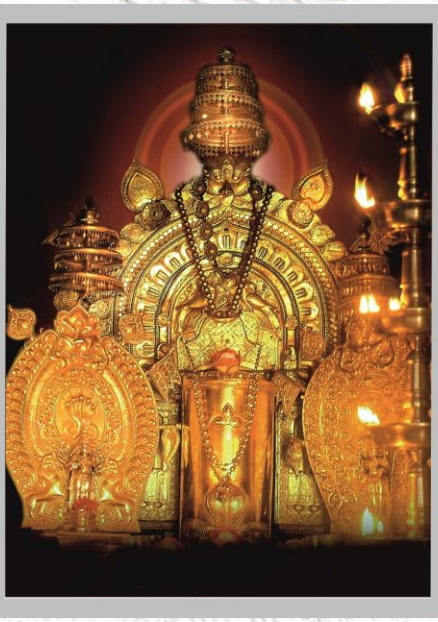
|| Om Shri Manjunathaya Namaha ||



Shree Kshethra Dharmasthala

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THE LOGO

Poojya Dr D. Veerendra Heggade, Hon'ble Chancellor of the University, while searching for an appropriate Logo for the University, saw a photograph picked from Temple Architecture showing Wings of a Bird, sculpted in Indian style and wanted it to be incorporated in the logo for the University, as the Wings symbolize 'Spreading of Knowledge beyond Boundaries'. Further it was felt that the Central theme of the logo should be 'Rudra' (The Linga) with three wings on each side. In this way, the logo of the University was conceptualized.

Hence:

1. The central part represents **Rudra** who Demolishes Darkness.
2. The Three **horizontal lines on The Linga** stand for Samyak Darshan (Right Belief), Samyak Gyan (Right Knowledge) and Samyak Charitra (Right Conduct).
3. The **Wings** symbolize spreading of Knowledge across the boundaries.
4. Base line **"Truth Liberates"** highlights the Purpose of Education: to liberate oneself unconditionally. It shows that it is not discipline, nor knowledge nor the efforts to freedom that liberate but Truth is what liberates you from all your conditioning and ignorance.

The overall significance of Shri Dharmasthala Manjunatheshwara University's Logo is:

Darkness of ignorance is destroyed by the flow of knowledge to bring Liberty to everyone, by realizing the truth. And, it should spread globally without the boundaries as hindrance.

SHRI
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UNIVERSITY

VISION

Shri Dharmasthala Manjunatheshwara University will set the highest standards of teaching and learning by awakening the intelligence of the students and nurturing the creativity hidden in them by creating an environment where the ancient wisdom blends with modern science, to transform them into whole human beings to face the challenges.

MISSION

- To ensure that the journey of education is inspiring, pleasant and enjoyable.
- Attract the best of teachers and students.
- Achieve high principles of trust, love and spirituality in the students.
- Create a collaborative, diverse and exclusive community.
- Transform the student of today to be a leader of tomorrow and a better human being.
- Produce passionate teachers.
- Evolve innovative teaching techniques.
- Create a peaceful environment.
- Prepare the student to face the social challenges.
- Create a University of which the Nation is proud of.
- Be an effective partner in Nation Building.
- Create an Eco-friendly University.
- Create a University based on the principles of beauty, love and justice.

||Om Shanti! Om Shanti! Om Shanti||

SHRI
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SDMU/ACAD/MED/PG/129A/2019

Date: 25-04-2019

NOTIFICATION

Ordinance governing Curricula of Medical Postgraduate Degree Courses in Para-clinical Subjects - 2019

Ref:
1. Minutes of the 1st Meeting of Academic Council held on 20th March 2019 (Letter No: SDMU/AC/M-01/093/2019; Dated:21-03-2019)
2. Minutes of the 2nd Meeting of Board of Management held on 22nd March 2019 (Letter No: SDMU/BOM/M-02/094/2019; Dated:23-03-2019)

In exercise of the powers conferred under Statutes 1.2 (Powers and functions - section viii), 1.4 (Powers and functions - section ix & x) of Shri Dharmasthala Manjunatheshwara University, the Board of Management is pleased to approve and notify the ordinance governing the Curricula of the following Medical Postgraduate Degree Courses in Para-clinical Subjects - 2019:

1. MD in Pathology
2. MD in Microbiology
3. MD in Pharmacology
4. MD in Forensic Medicine
5. MD in Community Medicine

The ordinance shall be effective for the students joining the course during 2019-20 and onwards.

REGISTRAR

REGISTRAR,
Shri Dharmasthala Manjunatheshwara
University, Dharwad

To: The Principal, SDM College of Medical Sciences & Hospital.

Copy for kind information to:
1. Hon'ble Vice Chancellor - Shri Dharmasthala Manjunatheshwara University.
2. Pro Vice-Chancellor (Academics) - Shri Dharmasthala Manjunatheshwara University.
3. Controller of Examinations- Shri Dharmasthala Manjunatheshwara University.

Shri Dharmasthala Manjunatheshwara University
DHARWAD

MD PHARMACOLOGY

I. GOALS

1. 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.
2. Acquisition of skills related to teaching, research methodology and corporate world.
3. Knowledge of elementary statistics and its applications.
4. Overall development of skills and personality of the PG resident.
5. Broaden the scope of Pharmacology from bench to bed side.

II. OBJECTIVES

To achieve the goals, the following objectives must be fulfilled:

At the end of MD Pharmacology Course a candidate, should become proficient in all aspects concerning drugs, and should have acquired skills and knowledge so as to opt for any of the following fields for his/her future career:

1. Teaching profession in a Medical Institution
2. Medical Research
3. Clinical Pharmacology
4. Pharmaceutical Industry

III. DURATION OF THE COURSE

The period of certified study and training for the Post-Graduate MD PHARMACOLOGY shall be three academic years (six academic terms). The academic terms shall mean six months training period.

IV. COURSE CONTENT

THEORY

1. Basic and General Pharmacology

a. Basic principles of pharmacodynamics and kinetics, including molecular pharmacology.
b. Historical aspects of drug discovery, development of new drugs and its evaluation in animals and man, drug development and regulations.
c. Pharmacogenomics and pharmacogenetics, gene based therapy and drug abuse.
d. Pharmacoepidemiology.
e. Drug delivery systems.

2. Clinical Pharmacology

a. Principles of clinical pharmacokinetics and their application in drug treatment.
b. Clinical trials.
c. Therapeutic drug monitoring.
d. Adverse drug reaction monitoring and Pharmacovigilance.
e. Principles of rational drug use and essential drugs concept.
f. Drug interactions.
g. Drug information.
h. Role of medicinal plants, dietary supplements and herbal medicines.
i. Pharmacometrics - methods of drug evaluation.
j. CRO visits: the student has to visit a reputed CRO (short listed by university/department) to have hands on experience in pharmaceutical industry work OR has to complete 10 days training at various workshops on clinical pharmacology (CME/Conferences/ Workshops) held at other reputed institutes.

3. Chemical Pharmacology

Structure activity relationship of important classes of drugs, basic principles of analytical techniques including spectrophotometry, chromatography and radio immuno assay.

4. Systemic Pharmacology and Therapeutics

Drug effects on various organ systems, including:

a. Autonomic Pharmacology.
b. Drugs acting on Smooth muscles.
c. Drugs acting on synaptic and neuroeffector junctional sites.
d. Drugs acting on central nervous system (sedative, hypnotics, antiepileptics).
e. General anesthetics, local anesthetics, skeletal muscle relaxants.
f. Antipsychotic, antidepressants, drugs used in Parkinson's disease and other neurodegenerative disorders, opioid agonists and antagonists).
g. Drugs modifying renal function.

h. Drugs acting on cardiovascular system and haemostatic mechanisms (antihypertensives, antianginal, antiarrhythmics, drugs used in heart failure, drugs used in dyslipidemias, fibrinolytics, anticoagulants, antiplatelets).
i. Reproductive pharmacology.
j. Agents effecting calcification and bone turnover.
k. Autacoids and related pharmacological agents (NSAIDs) and drugs used in rheumatoid arthritis and gout.
l. Gastrointestinal drugs.
m. Pharmacology of drugs affecting the respiratory system (drugs used in bronchial asthma and COPD).
n. Pharmacology of drugs used in endocrine disorders (drugs used in diabetes mellitus, hypothalamic and pituitary hormones, thyroid and antithyroid drugs, adrenocorticoid hormones and their antagonists, gonadal hormones and their inhibitors).
o. Antimicrobial, antiparasitics, disinfectants, antiseptics.
p. Chemotherapy of neoplastic disease.
q. Antiviral drugs.
r. Drugs used in autoimmune disorder and graft versus host disease, immunomodulators - immunosuppressants and immunostimulants.
s. Dermatological pharmacology.
t. Ocular pharmacology.
u. Screening procedures for various drug categories in humans and animals.

5. Toxicology

a. Drug poisoning and their management.
b. Environmental, occupational and industrial toxicology, non-metallic toxicants - air pollutants, pesticides etc.
c. Heavy metal poisoning.

6. Biostatistics

Basic principles and their application in drug research.

7. **Recent advances in Pharmacology.**

8. **Special problems related to drug use in different age groups, pregnancy and disease conditions.**
   a. Use of drugs in pregnancy.
   b. Perinatal and Pediatric Pharmacology.
   c. Geriatric pharmacology.

9. **Research Methodology:**
   The candidate shall get acquainted with various aspects of biomedical research, so as to enable him to undertake and supervise research projects.

   a. Basic principles and related aspects, research methodology and biostatistics, literature search.
   b. Ethical issues related to research on human subjects and animals.
   c. Ethical guidelines of ICMR, INSA and breeding and experiments on animals (control and supervision) rules 1998, CPCSEA Guidelines.

PRACTICAL

Objective: A candidate, after passing the M.D. Pharmacology examination should possess skills in testing the effects of drugs on the various experimental systems specified below. The candidate should also be well versed in interpreting and analyzing the observations and data obtained from studies.

1. **Experiments on Laboratory Animals**
   a. Anaesthetized animals: Dogs, cats. etc. (by computer assisted learning software).
   b. Small Animals: Methods of testing for local anaesthetics, anti-inflammatory drugs, analgesics, anticonvulsants, psychopharmacological agents, etc.
   c. Isolated tissue preparations:
      - Rabbits: Jejunum, heart.
      - Rats: Colon, uterus, fundus of stomach, phrenic nerve -diaphragm.
      - Guinea Pigs: Ileum, tracheal chain.
      - Frogs: Rectus muscle.
   d. Demonstration of techniques.

2. General screening and evaluation of:

a. Analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs.
b. Antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensive, hypocholesterolaemic agents, antiarrhythmics, diuretics, adrenergic blocking drugs.
c. Drugs used in peptic ulcer diseases/prokinetic agents/ antiemetics.
d. Antitussives, /anti-asthma agents.
e. Local Anaesthetics.
f. Oxytocics, antifertility agents.
g. Antidiabetics.
h. Behavioral pharmacology models and evaluation of drugs affecting learning and memory.

3. Bioassays

a. Bioassay methods.
b. Animal experiments: Ethical considerations, ethical approval, applicable regulatory guidelines (CPCSEA), humane animal research (principles of 3Rs) and alternatives to animal experimentation, general and statistical considerations.
c. Anesthetics used in laboratory animals.
d. Principles of EC50, ED50, pD2 and pA2 values of drugs.
e. Describe methods of bioassay for estimation of: Acetylcholine, skeletal neuromuscular junction blockers, adrenaline, noradrenaline, histamine, 5 HT, hormones, insulin, vasopressin/oxytocin, estrogen, progestin, ACTH.
f. Competitive antagonism - pA2 values.
g. Immunoassays: Concept, types of bioassays and their application/s.
h. Animal experiments: Ethical consideration, ethical approval regulatory guidelines (CPCSEA) and alternatives to animal experimentation.

4. Biochemical Pharmacology

a. Basic principles and applications of simple analytical methods.
b. Simple tests for detecting the chemical nature of drugs.

c. Principles of quantitative estimation of drugs, endogenous compounds and poisons using colorimetry, spectrophotometry, flame photometry, high performance liquid chromatography (HPLC) and enzyme-linked immunosorbent assay (ELISA).
d. Monitoring of drugs levels in body fluids candidates should acquaint with the techniques of monitoring drug levels, using systems like chromatography, spectrophotometry and immunossays.

V. SUBJECT SPECIFIC LEARNING OBJECTIVES

At the end of the training programme in MD Pharmacology, the student should acquire competencies in the following areas:

1. Acquisition of knowledge

The student should be able to explain clearly concepts and principles of Pharmacology and therapeutics. The student should also be able to explain the drug development processes. S/he should be able to explain Drugs and Cosmetics Act, in addition to clinical trial procedures.

2. Teaching and training

The student should be able to effectively teach undergraduate students in medicine (MBBS) and allied health science courses (dentistry and nursing) so they become competent healthcare professionals and able to contribute to training of undergraduate trainees.

3. Research

The student should be able to carry out a research project (both basic and clinical) from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas and to eventually be able to guide postgraduates in their thesis work.

VI. SUBJECT SPECIFIC COMPETENCIES

The student during the training program should acquire the following competencies:

1. Cognitive domain

a. Describe and apply pharmacological principles to explain the mechanism/s of the effects of drugs used in diagnosis, prevention and treatment of diseases of all systems of human body.
b. Explain pharmacodynamics and pharmacokinetics of drugs.
c. Describe mechanisms of drug-drug interactions and their clinical importance.
d. Apply and integrate knowledge of pathophysiology of diseases and its modulation by drugs.
e. Acquire knowledge on pharmacogenetics and pharmacogenomics.
f. Acquire knowledge on principles of pharmacoeconomics.
g. Acquire knowledge on pharmacoepidemiology, including drug utilization studies.
h. Acquire knowledge and understanding of principles of Good clinical practice (GCP).
i. (GCP) and Good laboratory practice (GLP) guidelines.
j. Acquire knowledge on essential medicines.
k. Acquire knowledge on Pharmacovigilance.
l. Acquire knowledge and apply the principle of biostatistics in the evaluation and interpretation of drug safety and efficacy studies.
m. Describe how to evaluate, analyze and monitor preclinical and clinical data in drug discovery.
n. Able to integrate principles of immunology in biochemistry.
o. Demonstrate knowledge of basics of research methodology, develop a research protocol, conduct the study, record experimental observations, analyze data using currently available statistical software, interpret results and disseminate these results and to have the potential ability to pursue further specializations and eventually be competent to guide students.
p. Describe the principles of teaching - learning technology towards application and take interactive classroom lectures, modules for problem

based learning (PBL), case discussions, small group discussions, seminars, journal club and research presentations.

q. Demonstrate knowledge about computer assisted learning (CAL) software and ability to use them efficiently to promote learning of pharmacology.
r. Demonstrate knowledge of principles of instrumentation.
s. Demonstrate knowledge about recent advances and trends in research in the field of pharmacology and clinical pharmacology.
t. Acquire knowledge on generic drugs and generic prescription.
u. Acquire knowledge on rational use of drugs and prescription auditing.
v. Acquire knowledge about antimicrobial stewardship programs and strategies for containment of antibiotic resistance.
w. Acquire knowledge on animal toxicity studies.
x. Acquire knowledge on common poisoning
y. Acquire knowledge on the legal and ethical issues involved in drug development and research.

z. Acquire knowledge in Biostatistics including use of statistical software:

a) Estimation of sample size for a clinical trial.
b) Scales of measurement, data display and measures of central tendency (mean, median, mode).
c) Dispersion of data (variance, standard deviation)
d) Selection of tests (of significance) and their applicability.
e) Correlation and regression analysis.
f) Basics of systematic reviews and meta-analysis.

2. Affective domain

a. Effectively explain to patients, the effects and side effects of drugs, including the need for medication adherence.
b. Communicate effectively with pharmacological reasoning with students, peers, staff and faculty, and other members of the health care team on rational use of drugs and improving spontaneous reporting of adverse events.
c. Demonstrate respect in interactions with peers, and other healthcare professionals.

d. Demonstrate ethical behavior and integrity in one's work.
e. Demonstrate ability to generate awareness about the use of generic drugs in patients.
f. Acquire skills for self-directed learning to keep up with developments in the field and to continuously build to improve on skills, expertise and perpetual professional development.

3. Psychomotor domain

a. Able to predict efficacy and adverse effects associated with use of drugs, along with causality assessment.
b. Demonstrate skills for prescription writing.
c. Perform major in vivo and in vitro animal experiments.
d. Observe and understand basic principles of working of important advanced techniques, like high performance liquid chromatography (HPLC).
e. Demonstrate standard operating procedures of various methods and techniques used in clinical trials and research.
f. Determine levels of common poisons in blood.
g. Demonstrate presentation skills at academic meetings, publications and writing research projects for funding agencies.
h. Be able to analyze and evaluate a research paper.

By the end of the course, the trainee should have acquired practical skills in the following:

1. In vivo and ex vivo experiments, like organ bath, analgesiometer, physiograph/ polygraph, convulsiometer, plethysmograph, learning and memory, models for affective disorders.
2. Administration of drugs by various routes (subcutaneous, intravenous, intraperitoneal) in experimental animals.
3. Collection of blood samples and oral gavage in experimental animals.
4. Preparation and administration of a drug solution in appropriate strength and volume.
5. Experiments to show dose response curve of agonists (in the presence or absence of an antagonist) on various biological tissues, like

a. Isolated rabbit/rat/ guinea-pig intestine.
b. Isolated rat uterus.
6. Determination of EC50, ED50, pD2 and pA2 values of drugs.
7. Perform *in vivo* experiments to study effect of mydiatrics and miotics on rabbit eye.
8. Perform *in vivo* experiments to study effect of antiepileptic drugs using animal Models of epilepsy.
9. Perform *in vivo* experiments to study effect of analgesics using animal models of analgesia.
10. Perform *in vivo* experiments to study effects of drugs on learning, memory and motor coordination.
11. Estimate toxic drug levels using chemical and biological tests (alkaloids, glycosides, steroids, barbiturates, salicylates) by commonly used methods).
12. Clinical pharmacology

a. Prepare protocol for a clinical trial.
b. Prepare Informed consent form and participant information sheet for research involving human participants.
c. Report serious adverse effect (SAE).
d. Evaluate promotional drug literature.
e. Prepare "Drug Information Sheet" (WHO criteria).
f. Interpret bioavailability parameters with the help of given pharmacokinetics data.
g. Perform causality assessment and report ADR as per Pharmacovigilance Programme of India (PvPI).

(<u>Animal Experiments:</u> All animal experiments will be compliant with Govt. of India regulations, notified from time to time. amphibian/dog/cat experiments will be conducted by computer assisted simulation models/ facilities. Other experiments will be performed as permissible by CPCSEA guidelines**)**

VII. TEACHING AND LEARNING METHODS OF THE POSTGRADUATE TEACHING PROGRAMME

Teaching methodology

Learning in a PG program will primarily be self-directed and consists of laboratory and academic work. The formal sessions are merely meant to supplement this core effort. Acquisition of practical competencies thus becomes the cornerstone of postgraduate medical education in Pharmacology.

1. Formal teaching sessions

In addition to laboratory work, at least 6-hr of formal teaching per week is necessary. The department will organize a mix of the following sessions:

a. Journal club- once a week.
b. Seminar- once a week.
c. Practical- once a week.
d. Group discussions- once a week.
e. Case discussions - once a month.
f. Interdepartmental case or seminar once a month.

***Note: These sessions will be organized as an institutional activity for all postgraduates*.**

2. A postgraduate student in pharmacology will have to attend accredited scientific meetings (CME, symposia, and conferences) regularly.
3. A postgraduate student in pharmacology would be required to present one poster presentation, to read one oral 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.
4. A postgraduate student in pharmacology will have to attend additional sessions on basic sciences, biostatistics, research methodology, teaching methodology, hospital waste management, health economics, medical ethics and legal issues related to experimentation.

5. A postgraduate student in pharmacology shall be required to participate in the teaching and training programme of undergraduate students and interns as put forth by the HOD.
6. Log book: During the training period, the post graduate student should maintain a log book giving details of experimentation done and skills acquired. The log book shall be used to aid the internal evaluation of the student. The log books shall be checked and assessed periodically by the faculty members imparting the training.

Proposed Weekly Time Table for MD Pharmacology

Day	**Morning**	**Afternoon**
Monday	Journal Club	Self-Study
Tuesday	Self-study/ Clinical postings*	UG teaching attendance
Wednesday	Animal Experiments/ Bioassay/ Chemical Tests	UG teaching attendance
Thursday	Animal Experiments/ Bioassay/ Chemical Tests	UG teaching attendance
Friday	Group discussion - Recent advances Clinical case	Self-study
Saturday	Seminar/Integrated Teaching	Dissertation/ Synopsis discussion

*General medicine, Emergency medicine, Surgery, Anaesthesia, Obstetrics & Gynaecology, Paediatrics, Dermatology & Venereology, Psychiatry.

The postgraduate student in M.D (Pharmacology) shall undergo a three year (6 term of 6 months each- 12 QUARTERS) training that will comprise of the following:

- **I Theory:** (lectures, seminars, group discussion, journal club) (at least 6 hours a week, daily 2 hours for 3 days).

- **II Rotation:**
  Practical training in the following suggested areas: (8 hours a week, daily 4 hours for 2 days).

1. Experimental Pharmacology:

In vitro (including bioassays), *in vivo* (including common methods of drug evaluation) experiments, computer simulations and toxicity tests.

2. Chemical Pharmacology:

Identification of drug/toxin by using chemical, biological and analytical tests
Quantitative estimation - use of colorimeter, spectrophotometer and/or other advanced analytical equipment.

3. Clinical Pharmacology:

a. Evaluation of drugs in healthy volunteers as well as patients.
b. Critical evaluation of drug literature, pharmacoeconomics, pharmacovigilance and pharmacoepidemiology.
c. Dissertation on a suitable research problem.
d. Training in undergraduate teaching/evaluation.
e. Computer assisted software training.

4. Postings in other departments:

A candidate of the M.D degree course in pharmacology needs to be well versed in the applied aspects of pharmacology and therapeutics. Actual postings in the wards of the clinical departments will help the candidate get acquainted with the patterns of drug use, rational drug therapy, adverse drug reactions and interactions etc., Such postings will also help him/her gain confidence in interacting with the clinicians, which will be needed if he chooses to be a clinical pharmacologist in his future career.

The following clinical postings are recommended:

Department	Period of Posting
General Medicine	2 Months
Pediatrics	1 Months
Anaesthesiology & I.C.U.	15 Days
Dermatology & Psychiatry	15 Days
Total duration	4 Months

These postings shall be during the initial phase of the studies. Monitoring postings in clinical departments would be through daily discussions with the department of pharmacology faculty during the afternoon session and as a part of maintenance of work diary.

5. **Desirable CRO visits:** the student has to visit a reputed CRO (short listed by university / department) to have hands on experience in pharmaceutical industry work OR has to complete 10 days training at various workshops on clinical pharmacology (CME/Conferences/ Workshops) held at other reputed institutes.

Schedule of work time table

I YEAR:

1st to 3rd month: Search and identify a topic for dissertation in consultation with guide and use of library, digital search etc., and preparation of synopsis.

4th to 6th month: Study of methodology of experiments, animal lab, maintenance of animals, study of instruments for experimentation, analytical chemistry, submission of synopsis to the university for registration.

7th to 10th month: Literature survey, preparation of reference cards, collection of relevant literature and journal work.

Apart from this, the student shall attend all the theory classes, practical, student tutorials and other teaching activities. They should also maintain work diary and duly get it countersigned by Head of the Department.

II YEAR & III YEAR

Candidates should practice all the experiments mentioned in the course content on weekly basis and also continue the experimental work of the dissertation. The candidate should complete compulsory clinical postings and should participate in seminars, journal clubs on weekly basis and file the seminars done to be presented

as a book for regular verification and sign by the head of department. They should undergo training in teaching skills as decided by the head of department. They should also maintain a daily log book of their work in the department for 3 years.

VIII. MONITORING PROGRESS OF P.G STUDENTS

1. **Work dairy / Log book**: Every candidate shall maintain a work diary and record his/her participation in the training programme conducted by the department such as journal reviews, seminars etc. Special mention is made of the presentations made by the candidate as well as the laboratory experiments conducted. The log book shall be scrutinized and certified by head of department every term.
2. **Periodic tests:** The department will conduct periodic tests which may include written paper, practical and viva - voce. Records and marks obtained in such tests will be maintained by head of department and sent to the university.

IX. DISSERTATION

1. Every candidate is required to carry out work on a selected research project under the guidance of a recognized postgraduate teacher. The results of such work shall be submitted in the form of a dissertation.
2. The dissertation is aimed to train the candidate in pharmacological research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of relevant literature, getting acquainted with recent advances, designing of research study, collection of data, and critical analysis of results and drawing conclusions.
3. The dissertation is to be submitted at least six months before the final examination as notified by the university to the Registrar (Evaluation).
4. Prior acceptance of the dissertation shall be a precondition for a candidate to appear for the final examination.

X. ASSESSMENT

A. Formative assessment

The assessment during the training i.e. formative assessment will be continual and will assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal assessment would be frequent, covering all domains of learning and used to provide feedback to improve learning; it will also cover professionalism and communication skills. The internal assessment will be conducted in theory and practical/clinical examination.

Quarterly assessment during the MD training should be based on:

a. Journal based / recent advances learning.
b. Patient based /laboratory or skill based learning.
c. Self-directed learning and teaching.
d. Departmental and interdepartmental learning activity.
e. External and outreach activities / CMEs.

The three year MD Pharmacology course would be of 12 quarters. The teaching learning and assessment of a post graduate student would be based on the quarters during the training period.

B. Summative examination

The summative assessment would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The post graduate examination shall be in three parts**:**

1. Thesis/ Dissertation

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized post graduate teacher, the result of which shall be written up and submitted in the form of a thesis/ dissertation. Work for writing the thesis/dissertation is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis/dissertation shall be submitted at least six months before the theory and clinical / practical examination. The thesis/dissertation 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 examination. A post graduate student shall be allowed to appear for the theory and practical examination only after the acceptance of the thesis/dissertation by the examiners.

2. Theory examination:

The examinations shall be organized to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D pharmacology shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There shall be four theory papers:

Paper I	General Pharmacology
Paper II	Clinical Pharmacology
Paper III	Systemic Pharmacology
Paper IV	Recent Advances in Pharmacology

In each theory paper, 10 Short notes (10 marks each) – 100 marks.

3. Practical/clinical and Oral/viva voce examination

Practical Examination (Total 200 marks)
Practical exams are to be held on 2 days, along with Viva-Voce.

Practical:

a. Experimental Pharmacology I (60 Marks) /Long Experiment:

Demonstrating effects of drugs/interpretation of results in anesthetized animal. Blood pressure, respiratory and any other possible recordings on anaesthetised animal: rat/rabbit/guinea pig/dog.

OR

Bioassay: 3 or 4 point assay using various isolated tissues like frog rectus, rat uterus, guinea pig ileum, rabbit duodenum etc.

b. Experimental Pharmacology II (60 Marks)/ Short experiment:
Interpretation of Graphs (20 Marks)

a) Recordings of– BP/ RR/ GIT for dog/cat.
b) Tracings of bioassay.

c. Demonstration of Technique (20 Marks)

Demonstrations of any one technique using small animals –rat/mice/rabbit, depending on the availability of equipment.

E.g.: Anti-inflammatory drugs/Straub's tail test/anti-convulsants/ analgesics/ / radial/ elevated Plus Maze/ CAL techniques, animal handling techniques and short experimental techniques.

d. Chemical Testing: (20 Marks)

Identification of any one substance by chemical testing for alkaloids/ glycosides/local anesthetics/Iodides/steroids/blood sugar estimation/urine sample for substance of abuse using spectrophotometer/calorimeter etc.

e. Clinical Pharmacology I (30 Marks)

a) Discussion in terms of – Rationality/ appropriateness/ correctness in prescribing using a clinical case or a simulated. paper case. ADR reporting and causality assessment (20 Marks)
b) Clinical exercise/ graph – comment/ answer questions. (10Marks)

f. Clinical Pharmacology II (50 Marks)

a) Clinical Trial Protocol Writing. (20 Marks)
b) Drug dosage calculations/ PK calculations. (15 Marks)
c) Critical evaluation of published article in clinical pharmacology. (15 Marks)

g. Microteaching/ Pedagogy (teaching exercise- 20 Marks): A topic is given to each candidate along with the practical examination question paper on the first day. Student is asked to make a presentation on the topic on the second day for 8 to 10 minutes.

Oral/Viva voce Examination

h. Viva voce (80 Marks): Students will be examined by all the examiners together about students' knowledge and comprehension of the prescribed course contents, analytical approach, expression and interpretation of data It includes discussion on dissertation.

MARKING SCHEME FOR PRACTICAL EXAMINATION

	Time	Practical Exercise
DAY 1	AM – 12.00 Noon	Chemical Pharmacology
		Screening/ technique demonstration
		Interpretation of Dog BP graphs
		Protocol writing
		Clinical case discussion
		Drug dosage calculations / PK calculations
		Clinical exercise/ graph
	1.00 PM – 5.00 PM	Bioassay
DAY 2	9.00 AM – 1.00 PM	Discussion on Bioassay Critiquing a published research article
	2.00 PM – 5.00 PM	Pedagogy Discussion on dissertation
		Viva –voce (theory)

Maximum marks for M.D. Pharmacology	**Theory**	**Practical**	**Viva**	**Grand Total**
	400	200	100	700

A student shall secure not less than 50% marks in each head of passing which shall include:

a. Theory.
b. Practical including clinical and viva voce examination.

XI. MAINTENANCE OF LOGBOOK

Each student shall maintain a log book in which the following details will be entered

1. Experiments performed by him /her.
2. Presentations in journal clubs along with title and issue details.
3. Interesting topics presented in clinical meetings with other departments.
4. Schedule and discussions during the clinical posting.
5. Details of discussion class in the department.
6. Conferences attended (National/International).
7. Paper presented at conference with title of the conference, date of presentation.
8. Paper published with title, name & issue of the journal.

It is a must for a post graduate student during the course to present one poster presentation and /or to read one oral paper at a national /state conference and /or to present one research paper which can be published/accepted for publication/sent for publication during the period of his/her postgraduate studies.

XII. RECOMMENDED READING MATERIAL

Text Books (latest edition)

1. Goodman & Gilman's The Pharmacological Basis of Therapeutics, ed. Laurence, Brunton, Bruce A. Chabner, Bjorn Knollman.
2. Essentials of Medical Pharmacology, by KD Tripathi.
3. Basic and Clinical Pharmacology, by Bertram G. Katzung and Anthony J. Trevor.
4. Drug Discovery and Evaluation: Pharmacological Assays Editors: Vogel, Hans Clinical Pharmacology by Laurence, Bennett and Brown.
5. Rang and Dale's Pharmacology by H.P. Rang.
6. Clinical Pharmacology, by P.N. Bennett, M.J. Brown.
7. Fundamentals of Experimental Pharmacology, by M.N. Ghosh.
8. Practical Manual of Experimental and Clinical Pharmacology, by Bikash Medhi, Ajay Prakash.

Journals

1. Journal of Pharmacology and Experimental Therapeutics.
2. Journal of Pharmacy and Pharmacology.
3. Drugs (Monthly Journal published by Adis International).
4. Clinical Pharmacology and Therapeutics.
5. Indian Journal of Pharmacology.
6. Annual Review of Pharmacology (Last 5 years)
7. Trends in Pharmaceutical sciences.

ADDITIONAL READING

1. Compendium of recommendations of various committees on Health and Development (1943-1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate General of Health Services, min. of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi. P - 335.

2. Santosh Kumar, The elements of Research, writing and editing 1994, Dept. of Urology, JIPMER, Pondicherry.

3. Indian Council of Medical Research, "Policy Statement of Ethical considerations involved in Research on Human Subjects", 1982, I.C.M.R, New Delhi.

4. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.

5. Francis C M, Medical Ethics, J P Publications, Bangalore, II edn, 2004.

6. Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi, 1994.

7. International Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991; 424-8.

8. Mahajan B K, Methods in Bio statistics for medical students, 5th Ed. New Delhi, Jaypee Brothers Medical Publishers, 1989.

9. Raveendran and B Gitanjali, A Practical approach to PG dissertation, New Delhi, J P Publications, 1998.

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Panoramic View of Campus